Department of Natural Resources

ECOLOGICAL LANDSCAPE ANALYSIS ST. GEORGES BAY ECODISTRICT 520

PART 3: Landscape Analysis for Forest Ecosystem Planners

ELA 2014-520

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 520: St. Georges Bay

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This report, one of 38 for the province, provides descriptions, maps, analysis, photos and resources of the St. Georges Bay Ecodistrict.

The Ecological Landscape Analyses (ELAs) were analyzed and written from 2005 – 2009. They provide baseline information for this period in a standardized format designed to support future data updates, forecasts and trends. The original documents are presented in three parts: Part 1 – *Learning About What Makes this Ecodistrict Distinctive* – and Part 2 – *How Woodland Owners Can Apply Landscape Concepts to Their Woodland.* Part 3 – *Landscape Analysis for Forest Planners* – will be available as a separatedocument.

Information sources and statistics (benchmarkdates) include:

- Forest Inventory (1997 to 1999) – stand volume, speciescomposition
- Crown Lands Forest Model landbase classification (2006) – provides forest inventory update for harvesting and silviculture from satellite photography (2005), silviculture treatment records (2006) and forest age increment (2006)
- Roads and Utility network – Service Nova Scotia and Municipal Relations (2006)
- Significant Habitat and Species Database(2007)
- Atlantic Canada Data Conservation Centre(2013)

Conventions

Where major changes have occurred since the original ELA report was written, the new information will be provided in *italics,* so that the reader can see how some conditions have changed since the benchmark date of the ELA.

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This in-depth Ecological Landscape Analysis (ELA) report is a lightly edited version of the original ELA produced by the Department of Natural Resources (DNR) as an internal document to assist with Crown land planning. The report provides information for planners, forest managers, ecologists, technicians, and woodland owners seeking detailed planning resources. In coming years the DNR will continue to develop landscape planning approaches and introduce additional tools to support sustainable management and biodiversity conservation. The Department is working with stakeholders to explore novel planning approaches using these methods.

The ELA provides tools to recognize and pursue common goals for sustaining ecosystem values across all ownerships within the province's diverse landscapes. The ELA is not a plan, but instead supports planning by providing a framework of ecosystem mapping, indicators, fine-scaled features, and landscape functions that help describe landscapes as ecological systems. The report comprises the four major sections outlined below, along with theme maps and appendices containing detailed data summaries:

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Understanding the Landscape as an Ecological System

(Appendices 1, 2a, 2b; Map 2)

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, which were interpreted through analysis using the ecosection layer of the Ecological Land Classification (ELC) for Nova Scotia. Elements are described by their potential vegetation (e.g. climax forest type) and physical features (e.g. soil, landform). These characteristics help determine historical vegetation patterns and promote an understanding of present distributions and potential habitat

development. Across the province about three dozen elements were identified in the ELAs and mapped to show their distribution across ecodistricts and ecoregions.

Elements Within Landscapes (Map 2)

The landscape analysis identified and mapped eight distinctive elements in the St. Georges Bay Ecodistrict – one matrix, six patches, and a corridor. A matrix is the dominant element. Patches are smaller yet still distinctive elements. Corridors are natural linear elements, such as river valleys, that extend across ecodistricts (see connectivity section for full discussion of matrix, patch, and corridor concepts).

Tolerant Hardwood Hills is the matrix element, representing 60% of the ecodistrict. On the upper slopes, this element naturally supports a forest of shade-tolerant species, such as sugar maple, yellow birch, beech, and white ash. On the lower slopes, the addition of red spruce and hemlock combine with the hardwoods to create mixedwood forests.

Spruce Pine Hummocks, representing 21.5% of the ecodistrict, is the largest patch element with forests dominated by black spruce, white pine, tamarack, and red maple. **Spruce Fir Hills and Hummocks** is the second largest patch, followed by **Floodplain**, which is mainly associated with smooth, level terrain along major rivers. The remaining three patch elements, in order of size, are **Coastal Beach, Wetlands,** and **Salt Marsh,** which represent less than 1% of the total area.

Valley Corridors, a linear element associated with major watercourses, accounts for 6% of the ecodistrict.

Flow – Element Interactions (Appendix 1; Map 2)

Flow phenomena are the features that move across and through landscapes. They can be energy or material, living or non-living. Diaz and Apostol (1992) suggest that the most relevant flows for landscape analysis may include water, wind, fire, animals, plants, and humans. The following flows were considered in the analysis of this ecodistrict and are described in Appendix 1: humans, water, mainland moose, fish, and sediment.

The main purpose in describing flows, and their relationship to the elements, is to provide insight into the role of each element. This will inform understanding of each element's contribution to overall landscape function.

Landscape Connectivity (Appendices 2a, 2b; Map 2)

Connectivity refers to the ease or difficulty that resources, such as water, animals, or even events – such as fires – can move within an area. As a basic ecological requirement, the ability to move without excessive risk is of critical importance for maintaining biodiversity at all levels, including genetic, individual, species, population, community, and ecosystem.

Connectivity takes many forms and operates at a wide range of scales. Among the structural ecosystem components that support movement, three major systems can be identified:

Matrix Ecosystems – Matrix implies large areas of broadly similar habitat in which movement is not constrained to particular routes. The slow spreading and mixing of species through the dominant community characterizes the ecosystem matrix. This "percolation" is dependent on the large patch conditions, which may be vulnerable to fragmentation. Interior habitat is often an important feature of matrix ecosystems.

Patch Ecosystems – The movement of species among patches of suitable habitat is dictated by the arrangement and size of patches and by a number of species' specific measures. Patches of suitable habitat must occur at acceptable distances over time. Some patch habitats have critical functions and must be continuously sustained, such as wetlands for migrating birds, feeding areas for deer, and calving grounds for moose. Other patches may be dynamic, shifting about the landscape as ecosystems evolve. Edge and interior habitat conditions are important features of patch ecosystems, as well as natural isolation.

River corridors may promote connectivity.

Linear Corridor Ecosystems – Flow along popular routes is dictated by enduring physical features, such as river valleys. Linear flow often requires continuous connection, such as rivers. Breaks in the connection serve as obstacles. It is a characteristic of continuous linear features that they often serve as connective corridors for some species and barriers for others.

Overall, the St. Georges Bay Ecodistrict has undergone extensive conversion from forest to agricultural land. Much of this was the result of small-scale farming that occurred in the 19th century and into the middle of the 20th century.

After the Second World War there was a decline in this way of life and white spruce became the dominate forest type on fields no longer used for agriculture. When this white spruce matured in the late 1900s it was heavily harvested for fiber and lumber.

In conjunction with harvesting, a considerable effort was put into softwood silviculture on harvested areas. This silviculture effort, in addition to natural regeneration of balsam fir and intolerant hardwood, has replaced what was previously a predominately gap disturbed tolerant hardwood forest. Currently, the hardwood matrix forest type only exists in small isolated areas.

On lower productivity areas and poorer drained sites, agriculture has not been as extensive. These sites, while heavily influenced by forestry, still retain some natural softwood forest patterns represented by mature stands of late serial species.

Suggestions for connective management strategies include:

- Mitigating the potentially negative barrier effects of concentrated land use in the valley corridors by sustaining and restoring natural communities in key areas such as those identified during the landscape analysis.
- Enhancing connectivity among conservation areas by applying appropriate medium and high biodiversity emphasis standards when managing areas with natural linkage potential.
- Improving ecoregional connectivity by sustaining and restoring natural conditions at important linkage points among ecodistricts.

Links to Neighbouring Ecodistricts (Appendices 1, 2a; Map 2)

Most of the landscape flows identified are also linkages to adjacent areas or ecodistricts (Map 2). Future management activities will recognize significant links to neighbouring ecodistricts and manage the forests in these areas to enhance and sustain connectivity.

Landscape Indicators (Appendices 3, 6, 7, 8, 9, 10, 11; Maps 3, 4, 5, 9, 10)

Indicators provide standard measures for assessing landscape conditions. Indicators can be used to develop goals, identify priority actions, assess trends, and support the evaluation of scenarios.

Forest Composition Indicators (Appendices 8, 10; Maps 4, 9, 10)

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

Human activities, such as forest harvesting, can shape the structure and composition of the forested landscape and should be planned to help support landscape composition goals.

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

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

- multi-aged / old forest (multiple layered / Old Forest Policy)

Seral stage indicators 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 (seral score 10 to 23)
- mid (seral score 24 to 37)
- late (seral score 38 to 50)

A look-up table (see Appendix 8) assigns each species in the forest inventory a value from one to five representing its position on the successional scale. These values are applied to the species composition data in the forest inventory to calculate a seral score, which may range from 10 to 50.

Covertype indicators 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%)

Target Ranges for Composition Indicators

Table 7 provides target ranges for development class and seral stage composition appropriate for different disturbance regimes. These ranges have been derived from the professional judgment of DNR forest ecologists to guide composition objectives for large landscape areas. This guidance can be used to assess how land holdings contribute to the overall ecodistrict structure by referring to the element analysis section which summarizes the levels of these indicators.

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

Table 7 - 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%

Forest Vegetation Types for Seral Stages in Each Element

Each element contains a number of forest stands that can be classified by vegetation, soil, and ecosites. The DNR publication ***Forest Ecosystem Classification for Nova Scotia, Part I: Vegetation Types (2010)*** (http://novascotia.ca/natr/forestry/veg-types/veg-navigation.asp) is helpful in identifying forest plant communities. Table 8 presents a description of the vegetation types likely to be found within elements, along with the current percentage of each seral stage.

Table 8 – Forest Vegetation Types[1] Within Elements in St. Georges Bay						
Element	**Seral Stage**					
	Early	**% ***	**Middle**	**%**	**Late**	**%**
Floodplain	FP4, FP5, FP6	58.0	FP3	12.0	**FP1**	9.0
Spruce Pine Hummocks	IH1, IH4, IH6, SP10	43.0	SP4, SP6, SP8	19.0	**SP5**, SP7	21.0
Spruce Fir Hills and Hummocks	SP10, IH4, SP6, SP8	46.0	MW4, MW5	15.0	**SH9, SP7,** SH8, SH10	19.0
Tolerant Hardwood Hills	IH6	56.0	IH7, TH7	14.0	**TH1, TH2**, TH3, TH4, **TH8**	11.0
Salt Marsh	Grasslands of *Spartina spp.*					
Coastal Beach	CO7, Beach grass, Bayberry, Rose spp., White spruce					
Wetlands	WC1, WC2, WC6, WC7, WD1, WD2, WD3, WD5, WD6, WD7					
View forest groups and vegetation types at http://novascotia.ca/natr/forestry/veg-types/veg-navigation.asp To help with identification of vegetation types, the 14 forest groups in Nova Scotia designated by DNR are: Cedar (CE), Coastal (CO), Flood Plain (FP), Highland (HL), Intolerant Hardwood (IH), Karst (KA), Mixedwood (MW), Old Field (OF), Open Woodland (OW), Spruce Hemlock (SH), Spruce Pine (SP), Tolerant Hardwood (TH), Wet Coniferous (WC), Wet Deciduous (WD) **Bolded vegetation types** indicate typical late successional community [1] Forest Ecosystem Classification for Nova Scotia (2010) *Percentage of element in each successional stage. Percentages may not total 100 due to unclassified lands (such as clearcuts and regenerating stands) not being included.						

Land Use Indicators (Appendices 3, 4, 5; Maps 6, 7)

Two indices (Ecological Emphasis Index and Road Index) have been developed to measure the relative pressure that current human land use exerts on ecosystems.

Ecological Emphasis Index (Appendices 11, 12; Map 3)

A variety of land management practices occur across landscapes, ranging from natural reserve areas to highly modified urban environments. Conserving biodiversity requires a balancing of land use practices to sustain ecological integrity.

To assist in assessing land use intensities and develop appropriate practices, four levels of ecological integrity are defined based on the degree that the conservation of natural conditions is emphasized in the management practices and policies applied to the land:

- Reserve, such as parks or wilderness areas
- Extensive, which are lands managed or restored for multiple values using ecosystem-based techniques
- Intensive, optimizing resource production by management techniques that may reduce biological diversity, such as plantations; but also meet the Wildlife Habitat and Watercourses Protection Regulations (NSDNR, 2002)
  (See http://www.gov.ns.ca/natr/wildlife/habitats/protection)
- Converted, lands altered for agriculture, roads, or other human activities

All lands within the ecodistrict are assessed at the stand level and assigned one of these four ecological emphasis classes (EEC) based on past practices. These classes are mapped over all areas of the landscape using a one hectare grid. The Ecological Emphasis Index (EEI) is determined by assigning a weighting value to each class: Reserve (100), Extensive (75), Intensive (25), and Converted (0). An overall index value may be calculated for any area of interest, such as element, ecosection, ecodistrict, or ecoregion, by averaging the index values within the area to provide a relative indication of land use pressure.

The St. Georges Bay Ecodistrict is generally rural in nature with the exception of the area around the town of Antigonish, which could be considered urban. The overall EEI is 43 to 53, which indicates the intensity of land use may be of concern regarding its impact on biodiversity.

Appendix 12a shows that 27% of the lands have been converted to non-forest use. The other ecological emphasis classes, in order of size, are extensive (48%), intensive (5%), and reserve (1%), leaving 19% as unclassified.

DNR will continue to develop and evaluate other measures of conservation risk.

Road Index (Appendices 6, 7; Map 5)

The GIS-based “Road Index” provides a standard assessment and mapping of road distributions across ecodistricts to assist planners to objectively explore options for managing road networks and assess the intersection of road affects with other features of the landscape. Density, distance,

and type of linear feature (e.g. road types, power lines) are used to calculate index values that indicate relative road pressure. The index value is mapped over all areas of the landscape using a one hectare grid. The overall index may be calculated for any area of interest, such as element, ecosection, ecodistrict, or ecoregion, by averaging the index values within the area to provide a relative indication of land use pressure. The index provides a numerical indicator of road influence that can be used to monitor temporal changes and compare different landscapes.

In discussing road ecology, Forman (2004) describes five distinctive landscape types in North America: city-suburb, agricultural, forestry, arid-grassland, and natural landscape. Each landscape type has a characteristic pattern of road networks with distinctive ecological effects and planning considerations (Forman & Hersperger 1996). These were adapted in Nova Scotia to classify five Road Index Benchmark Ranges associated with particular land use settings:

- Remote Landscape (RI 0 to 6): Unpopulated with few roads, trails, or other linear features
- Forest Resource (RI 7 to 15: Forest access roads are the primary linear feature
- Mixed Rural (RI 16 to 24): Mixed land use of rural settlement, forestry, and agriculture
- Agriculture/Suburban (RI 25 to 39): Suburban settlement and/or open agricultural fields
- Urban (RI 40 to 100): Urban environment with high building densities, roads, and few tracts of undeveloped land outside municipal parks

Road, trail, and utility corridors are vital components of human land use. However, transportation systems are expensive and produce many undesirable environmental effects, such as chronic siltation, invasion routes for exotic species, fragmentation, loss of productive land, and increased human presence.

Low road density areas are important features for biodiversity conservation. Planning should consider block scheduling options, life expectancy, class requirements, decommissioning strategies, and overall landscape function, in order to develop efficient access systems designed to minimize environmental impacts.

St. Georges Bay has an overall Road Index of 9, which falls in the Forest Resource class, which represents nearly half of the ecodistrict (Appendix 7).

The other classes, in order of size, are Mixed Rural (25%), Remote (15%), Agriculture Suburban (8%), and Urban (2%).

Salt Marsh is the element with the highest Road Index at 53, while the Tolerant Hardwood Hills matrix element is lowest at 7.

Fine Scale Features (Appendices 3, 4, 5; Maps 6, 7)

Data on the status and location of priority species, ecological land classification, representivity analysis, and other landscape characterization themes were used to identify special occurrences, rare ecosections, and ecological representivity. These fine scale features, which occur at a sub-landscape level, may require special management practices to conserve their uncommon characteristics.

Lindenmayer and Franklin (2002) refer to the importance of identifying "midspatial-scale" features and "patch-level habitats," including: 1) aquatic ecosystems, such as streams, lakes, and ponds; 2) wildlife corridors; 3) specialized habitats, such as cliffs, caves, thermal habitats, meadows, and vernal pools; 4) biological hotspots or places of intense biological activity, such as calving sites, over wintering grounds, and spawning habitats; and 5) remnants of old forest.

Priority Species and Other Special Occurrences (Appendix 3; Map 6)

Landscapes and ecosystems comprise many species of plants, animals, and other organisms. Some of these species are given priority in planning, management, and stewardship because they are rare, and/or at risk of going extinct locally or on a larger scale. The status and location of these species are important and data are collected, compiled, and assessed on an ongoing basis.

The primary species data used in this report are from the Atlantic Canada Conservation Data Centre and DNR's Significant Habitat Database. Efforts are made to ensure data are as accurate and up-to-date as possible. Lists and maps indicate what is currently known. Due diligence tied to planning, management, and stewardship may require that surveys be carried out to update information or to fill gaps in our knowledge. Priority species may require special actions in terms of forest management and other activities that alter habitat and the landscape. If more information is required or if management specific to a priority species need to be developed, a regional biologist, Wildlife Division staff, or other species experts should be contacted.

This section includes species at risk (refer to Table 1a, Appendix 3), species of conservation concern (Table 1b, Appendix 3), other conservation features (Table 1c, Appendix 3), and heritage features (Table 1d, Appendix 3, where available). *The list of species at risk and species of conservation concern was obtained from the Atlantic Canada Conservation Data Centre (ACCDC) databases, current to 2013*.

Species at Risk

The term "species at risk" is generally used to describe those species that are, to some extent, protected under provincial or federal endangered species legislation. Usually these species are protected where they occur on provincial, federal, and private lands. In Nova Scotia, the two main pieces of endangered species legislation are the Nova Scotia Endangered Species Act (NSESA) and the federal Species at Risk Act (SARA). Species can be classified as "endangered," "threatened," "vulnerable/special concern," or as "extinct" or "extirpated." In most cases for species at risk, recovery planning and special management are in place, as well as legal protection (See http://novascotia.ca/natr/wildlife/biodiversity/at-risk-overview.asp).

Species of Conservation Concern

The term "species of conservation concern" refers to those species that are a high priority for conservation and special attention during planning, management, and stewardship. These species may be rare and/under a variety of threats but the threats do not currently warrant species at risk designation. In some cases these species could meet the criteria for a species at risk but a formal

species at risk assessment has not been done. Species of conservation concern are a priority in landscape planning because a focus on them now can prevent these species from becoming species at risk later.

Species Ranking and Coding Systems

A number of ranking and coding systems identify and convey the status of species at risk and species of conservation concern. Some of this information is provided in Appendix 3 and Map 6 and is routinely used in planning, management, and stewardship activities.

Colour-coded "traffic light" systems are used provincially and nationally. These systems use "red to orange/yellow to green" categories to indicate the most at risk species (red) to the least at risk species (green). Details of these systems are available from the Wildlife Division.

A second system commonly used is NatureServe Conservation Data Centre system. This system uses numbers from 1 (extremely) to 5 (widespread, abundant) to denote the relative rarity and conservation concern for species. At the provincial scale numbers are prefixed with "S" to indicate that this is a state/provincial level rank. Ranks at the National (N) and Global (G) levels are also available for all species. In Nova Scotia, the Atlantic Canada Conservation Data Centre (http://www.accdc.com/) works with partners to provide ranks and data on species' occurrence.

As of 2014 in the St. Georges Bay Ecodistrict, there are documented occurrences (under the NSESA) of the following number of formally listed species at risk: nine endangered, three threatened, and three vulnerable. In addition to the listed species, the national General Status process also identifies 25 orange species, 42 yellow species, 33 green species, and three undetermined species for a total of 103 other species of conservation concern in this ecodistrict (Appendix 3, Table 1a and Table 1b).

Provincially endangered species include six birds and three mammals. Threatened species include two birds, one dicot (plant), and one reptile. Two bird species and one reptile species are listed as vulnerable.

The 103 other species of conservation concern are represented by 53 plants, 33 birds, 15 insects, two mollusks, one mammal, and one fish (Appendix 3, Table 1b).

The sand beaches of the Northumberland Strait within the St. Georges Bay Ecodistrict provide habitat for the endangered piping plover.

Birds

Many of the federal or provincially designated species at risk and species of conservation concern have experienced significant declines in numbers, habitat availability, and/or are especially vulnerable to human land use activities. Not all species on these lists regularly occur (even in small numbers) in this ecodistrict, but records indicate their reported presence at some time. Examples of these would include red knot, northern pintail, Hudsonian godwit, and Hudsonian whimbrel.

Provincially endangered bird species in this ecodistrict are red knot, piping plover, chimney swift, barn swallow, Canada warbler, and rusty blackbird. Common nighthawk and olive-sided flycatcher are designated as threatened. There has been a nationwide decline in chimney swifts and common nighthawks, as well as other aerial insectivores due to declines in insect food species and nesting habitat. Nationally, both are designated threatened by COSEWIC and SARA. Eastern wood peewee and bobolink are classed as vulnerable within the province.

As of 2010, in addition to endangered, threatened, or vulnerable species listed under the NSESA, an additional 18 yellow-status (sensitive) bird species have been found in the ecodistrict. Habitat loss, land use practices, and in some cases competition with other species have impacted all of these species in recent years. Some examples of bird species in this sensitive category are eastern bluebird, American bittern, gray jay, boreal chickadee, killdeer, rose-breasted grosbeak, common tern, and greater yellowlegs.

Mahoneys Island (formerly Mahoneys Beach), Dunns Beach, Port Hood Station Beach and Pomquet Beach account for nesting piping plover in this ecodistrict.

Mammals

The Nova Scotia mainland moose has been designated an endangered species under the Nova Scotia Endangered Species Act. Mainland moose are genetically distinct from those on Cape Breton Island, where moose populations are healthy. Moose are commonly associated with forested landscape habitats that have been altered or disturbed by an event such as fire, wind (i.e. blow down), disease, or timber harvesting. The habitat requirements of moose are largely dependent on successional forest stages. Early succession hardwood trees and shrubs provide necessary browse vegetation while mature conifer cover is critical for shelter, thermal cover, and protection in winter and summer.

Prior to the introduction of forest harvesting as a disturbance regime, the availability of moose habitat in this ecodistrict would have historically been tied to natural disturbances that produced patches in the hardwood forest canopy (gap disturbances) or effected larger areas of spruce-pine forests from insects, fire, or wind (frequent disturbances).

Moose or signs of moose are regularly observed in the St. Georges Bay Ecodistrict. This ecodistrict forms part of the Significant Mainland Moose Concentration Area, an area considered to be "occupied moose habitat" (an area with recurrent observations of moose over time). As a result, landowners and users are required on Crown lands and encouraged on private lands to adopt Special Management Practices (SMPs) to provide for important elements of moose habitat.

Nova Scotia's Forest / Wildlife Guidelines and Standards provide minimum habitat specifications for moose on Crown land through the 8% retention for old growth, maintenance of a 20 metre minimum buffer zone along water courses, and through the maintenance of reasonable forest development class distribution. Additional measures (SMPs) to provide for specific habitat needs of moose have been identified to address the need for thermal refugia, aquatic feeding sites, and calving areas. However, because of the low proportion of Crown land ownership in this ecodistrict, opportunities for managing Crown forests as potential moose habitat will be limited.

In addition to mainland moose, there are two other mammal species that are provincially endangered, the little brown myotis, and the northern myotis. Both of these locally found bats have experienced

significant population declines as the result of bat white-nose syndrome, a fungal disease that has spread throughout eastern North America including Nova Scotia during the past three years. Nova Scotia bats are important predators of insects which includes a variety of moth species whose larval stage impact the foliage of forest trees.

Fish

Atlantic salmon, which have a red status in Nova Scotia, have historically utilized rivers in this ecosection for spawning. Salmon numbers in this ecodistrict appear to be stable at the moment but are declining elsewhere in the province and are considered to be extirpated from most rivers in southwest Nova Scotia. Atlantic salmon are divided into several populations within the province, most of which are designated as endangered by COSEWIC and protected under the federal Species at Risk Act. Salmon in this ecodistrict are part of the Gaspe-Southern Gulf of St. Lawrence population and are designated as special concern by COSEWIC.

Human influences have caused a decline in native resident brook trout populations in Nova Scotia, and as a result this species has been given a yellow status. The St. Georges Bay Ecodistrict has several rivers that support sea-run brook trout populations. Another anadromous fish with a red status in Nova Scotia that occurs in waters adjacent to the St. Georges Bay Ecodistrict is the striped bass. Although there are concerns with this species at the federal level, Nova Scotia striped bass populations have increased sufficiently that there is a limited recreational fishery for this species. Striped bass spawn in estuaries and, like all fish species, can be impacted by land use practices that create excessive sedimentation in watercourses.

Reptiles

St. Georges Bay Ecodistrict contains two turtle species that are considered species at risk. The wood turtle is threatened at both provincial and federal levels and occurs in small numbers in at least three watercourses. Special management practices are in place for activities on Crown lands that may impact this turtle and its habitat. Nesting beaches and overwintering sites are important habitat components that need to be protected.

The snapping turtle, the largest terrestrial / freshwater turtle in Nova Scotia, is considered a species at risk.

The second turtle species at risk is the snapping turtle. Although this long-lived species is fairly common in most watersheds in Nova Scotia, the population is under increasing threats and consequently has been designated as vulnerable under the NSESA. The low recruitment of turtles to breed, low juvenile survival, poor nesting success, illegal harvest, and road mortality all are threats to the province's largest terrestrial / freshwater turtle. Because turtles are long-lived with low breeding success, any mortality of adults can have an impact on population levels.

Mollusks

Some of the most imperiled organisms in North America belong to the freshwater mussel group. These species rely on fish to complete their life cycle and consequently the same factors that impact fish populations also affect mussels. Pollution, sedimentation, loss of habitat, and host fish and impediments to fish passage are the primary threats.

In the St. Georges Bay Ecodistrict, there are two freshwater mussels that are of conservation concern: the triangle floater and the eastern lampmussel. Adherence to the Wildlife Habitat and Watercourse Protection Regulations should be enough in most instances to protect the habitat of these species.

Plants

The St. Georges Bay Ecodistrict contains one formally recognized plant species at risk and 52 other plant species of conservation concern. The black ash is listed as threatened under the NSESA. Of the remaining 52 species, 16 are orange (may be at risk), 19 are yellow (sensitive), 12 are green (secure), and four are undetermined.

Black ash is a widely distributed but uncommon tree in Nova Scotia that is a culturally significant species to the Mi'kmaq who use the wood for a variety of purposes. This species is slow to mature and produces seeds sporadically between one- and eight-year intervals. Black ash is particularly susceptible to fungal diseases, invasive species such as the emerald ash borer, poor growth, and stunting.

Other notable plants occurring in this ecodistrict are Canada lily, yellow lady's slipper, showy lady's slipper, white snakeroot, estuary beggarticks, buttonbush dodder, and wooly beach-heath.

Rare Ecosections (Appendices 3, 12b; Map 7)

The Ecological Land Classification for Nova Scotia (Neily et al. 2003) classifies ecosections based on similar characteristics of landform, soils, and vegetation. These are the smallest mapped unit, and they repeat within ecodistricts.

Ecosections have characteristic natural disturbance regimes and climax types. Landscape elements were identified by combining ecosections with similar characteristics. Table 9 provides explanations of ecosections and their relationship to elements.

Ecosections that are rare (< 2% of ecodistrict area) or under high land use pressure (> 75% land conversion) are identified in Appendix 3.

Table 9 – Elements, Ecosections, Disturbance Regimes andClimax Types

520 St. Georges Bay Ecodistrict			
Landscape Element and Type	**Ecosections***	**Dominant Natural Disturbance Regime**	**Dominant Climax Type**
Tolerant Hardwood Hills (Matrix)	WMDM WMDS WFKK WCKK WMKK WFHO	Gap	sugar Maple (sM), yellow Birch (yB), Beech (Be)
Spruce Pine Hummocks (Patch)	WMHO WCHO ICHO IMHO WCRD IFHO PFHO IMSM	Frequent	black Spruce (bS), white Pine (wP)
Spruce Fir Hills and Hummocks (Patch)	IFKK	Frequent	bS, wP, balsam Fir (bF)
Floodplain (Patch)	IFSM WFSM WCSM	Gap	American Elm (aE), sM, white Ash (wA)
Coastal Beach (Patch)	XXCB	N/A	
Wetlands (Patch)	WTLD	Open Seral (Frequent)	bS, red Maple (rM), tamarack (tL)
Salt Marsh (Patch)	XXSM	Open Seral	
Valley Corridors (Corridor)	Various	Various	Various

***Ecosection Explanations**: For example, in **WMHO**, **W** stands for Well-drained under Soil Drainage **M** stands for Medium-textured under Soil Texture and **HO** stands for Hummocky under TopographicPattern

Soil Drainage: **W –** Well-drained **I –** Imperfectly drained **P** – Poorly drained **WTLD** – Wetland

Soil Texture: **C** – Coarse-textured soils (e.g. sands) **M** – Medium-textured soils (e.g. loams) **F** – Fine-textured soils (e.g.clays)

Topographic Pattern: **SM** – Smooth or flat **KK** – Hills **HO** – Hummocky **DM** – Drumlinoid **RD** – Ridges **DS** – Canyons and steep slopes

Within the St. Georges Bay Ecodistrict there are nine ecosections (IMHO, IMSM, PFHO, WCRD, WCSM, WFSM, WMDM, WMDS, and WTLD) that each comprise less than 2% of the ecodistrict area. These nine ecosections combined form 3.5% of the ecodistrict.

Opportunities for future management to implement existing policies and develop additional practices to address fine filter conservation issues include:

- Recognition of uncommon forest species whose genetic viability may be threatened, as indicated by DNR's General Status of Wildlife rating system. Many of these species are also listed under the Nova Scotia Endangered Species Act (NSESA) or the federal Species at Risk Act (SARA) and many of these have recovery plans in place to direct conservation actions.
- Seeking fine filter management opportunities related to conservation of significant habitats.
- Recognition of importance of uncommon community conditions (e.g. old age, large live and dead trees and species associations).

Ecological Representivity (Appendices 4, 5)

Ecological representivity describes the degree that the range of natural ecosystem diversity (elements, ecosections) is secured within reserve systems (e.g. Parks, Wilderness, Old Growth Policy).

The overall goal is biodiversity conservation through protection of natural habitat diversity. Ecological representation is employed as a "coarse scale" ecosystem planning concept. The analysis evaluated and identified the reserve status of the ecosections and climax communities located within the ecodistrict where two levels of reserves were recognized: legally protected reserves, such as Wilderness Areas; and policy protected reserves under the Integrated Resource Management (IRM) classification to include old forest, Eastern Habitat Joint Venture Sites, non-designated provincial park reserves, and non-designated sites of ecological significance.

The IUCN is The World Conservation Union (formerly the International Union for the Conservation of Nature) which developed a standard international system for categorizing and reporting on the world's protected areas.

Provincial parks, a site of ecological significance, a Nature Conservancy of Canada property, and protected beaches are legal reserves under the IUCN I, II or III, accounting for 999 hectares or 1.1% of this ecodistrict. The provincial Old Growth Policy protects another 379 hectares of forest stands on Crown land under policy reserve. In total, 1.7% of the ecodistrict has legal reserve or policy reserve protection.

ELA Summary

Element Interpretation (All appendices and maps)

The lowlands wrapping around St. Georges Bay extend inland to the Mulgrave Plateau Ecodistrict 360 on the mainland and the Cape Breton Hills Ecodistrict 310 on Cape Breton Island. Including most of Antigonish County and incorporating the Judique lowlands of Inverness County, this area has been used extensively for farming.

Elevations are between 30 and 60 metres above sea level although there is a consistent rise inland from the coast to an elevation of 150 metres. Much of this elevation is on gently rolling hills that have been cleared and used for agriculture.

Underlying the ecodistrict are Lower Carboniferous sedimentary rocks of sandstone, shale, and limestone. In some areas, gypsum outcrops and associated karst topography can be seen. One of these areas is the cliffs along St. Georges Bay, north of Antigonish.

Deposits of alluvium and stratified sand and gravel can be found adjacent to the major rivers of the ecodistrict. The soils of the ecodistrict are dominated by moderately well and imperfectly drained gravelly loams and gravelly clay loams.

Well-drained sandy loams are predominant along the coast, with rapidly drained, gravelly sandy loams on the outwash plains of the major rivers. The alluvial soils are usually moderately well-drained silty, clay loams.

The extensive agricultural history has modified many of the natural forest communities. Abandoned agricultural lands revert to stands of white spruce. In Antigonish County, there are more than 10,000 hectares of forest stands where white spruce comprises at least 30% of the cover.

However, pre-European settlement forests most likely included tolerant hardwood stands of sugar maple, yellow birch, and beech on the upper slopes, with tolerant softwoods such as red spruce, white pine, and hemlock becoming more abundant on the lower slopes.

Imperfectly drained flats are dominated by black spruce, which can be observed along the Judique shore. Recently disturbed forested sites will regenerate with balsam fir, red maple, white birch and on the wetter sites, aspen and tamarack.

Tolerant Hardwood Hills

(Matrix) (WMDM, WMDS, WFKK, WCKK, WMKK and WFHO ecosections) (53,137 ha)

The area identified as the matrix within the St Georges Bay Ecodistrict contained the dominant historical forest cover, consisting primarily of tolerant hardwoods with lesser amounts of softwood and mixedwood stands. The latter two types were located on lower slope positions.

Land use and ownership patterns have greatly affected the matrix resulting in the remaining forested portion being primarily in the establishment to young development classes, with over half in the early seral stage.

Covertype has changed from primarily hardwood to approximately half softwood. Agriculture has resulted in non-forested conditions replacing a significant portion of the historical matrix forest.

Flows

Humans (settlements, transportation, forestry, recreation, agriculture, exploration and development of minerals, oil and gas); water (regulation of water quality and quantity); mainland moose (cover and forage); fish (regulation of water quality and quantity); sediment (supplies some of the coastal and inland sediment).

Composition

St. Georges Bay Ecodistrict 520 (based on statistics up to 2006)

Composition of Tolerant Hardwood Hills

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	45%	19%	36% (26 Mat + 10 OF)	10%
Seral Stage	Early	Mid	Late	Unclassified
	55%	14%	11%	20%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	49%	14%	28%	9%

Desired Condition

Predominately mature late seral hardwood on forested portions of historical matrix area. The small private land ownership pattern and level of land use will inevitably maintain some non-forested conditions within the matrix area.

Spruce Pine Hummocks

(Patch) (WMHO, WCHO, ICHO, IMHO, WCRD, IFHO, PFHO, and IMSM ecosections) (19,041 ha)

This element features generally hummock type topography with inherent stands of black spruce on imperfectly drained sites, tending toward some hardwood and tolerant softwood content on better-drained soils.

Current forest has a higher hardwood component in hardwood and mixedwood stands than might be expected in the predicted inherent stands types.

The amount of hardwood is likely a function of the exit to which better-drained sites contain early seral stage and establishment development classes resulting from forest harvesting.

Flows

Humans (forestry, recreation, exploration and development of minerals, oil and gas); water (regulation of water quality and quantity); mainland moose (mainland portion of element, preferred moose habitat within ecodistrict, contains potential calving sites); fish (regulation of water quality and quantity, food supply); sediment (potential source of inland sediment).

Composition

St. Georges Bay Ecodistrict 520 (based on statistics up to 2006) **Composition of Spruce Pine Hummocks**				
Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	40%	20%	40% (28 Mat + 12 OF)	12%
Seral Stage	Early	Mid	Late	Unclassified
	43%	19%	21%	17%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	52%	12%	31%	5%

Desired Condition

Stand conditions tending toward a predominately black spruce forest, with lesser amounts of white pine, tolerant softwoods, and some hardwood on portions of the element with better-drainage. A relatively even distribution of development classes and representation from all seral stages.

Spruce Fir Hills and Hummocks

(Patch) (IFKK ecosection) (6,806 ha)

The forests tend to be dominated by black spruce, white spruce, and balsam fir. With progressively poorer drainage, black spruce, tamarack, and red maple dominate the forest vegetation and wetlands are embedded throughout the element.

Early successional forests tend to have a higher component of aspen, tamarack, and balsam fir but overall regenerating forests from stand-level harvesting will also include red maple, white birch, grey birch, and pin cherry.

The dominant natural disturbances are frequent and result in primarily even-aged forests. Natural disturbance agents include fire, windthrow, and insects, such as the spruce budworm if forests have a high component of balsam fir.

Flows

Humans (settlement, forestry, recreation, agriculture exploration and development of minerals, oil and gas); water (regulation of water quality and quantity); mainland moose (mainland portion of element, similar use as with black spruce element less calving areas); fish (regulation of water quality and quantity, food supply); sediment (potential source of inland sediment).

Composition

St. Georges Bay Ecodistrict 520 (based on statistics up to 2006)
Composition of Spruce Fir Hills and Hummocks

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	46%	15%	39% (33 Mat + 6 OF)	6%
Seral Stage	Early	Mid	Late	Unclassified
	46%	15%	19%	20%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	59%	7%	28%	6%

Desired Condition

Black spruce and white pine stands, with the majority of the element containing mature stands of mid to late vegetation types of black spruce, white pine, and lesser amounts of hardwood.

Floodplain
(Patch) (IFSM, WFSM and WCSM ecosections) (3,299 ha)

Fine-textured soils on smooth ecosections associated with water courses. Approximately half of this element type has been incorporated into the corridors which were identified for this ecodistrict. Over half of this element is in the establishment to young development classes and in early seral vegetation types. This is more characteristic of recent frequent disturbances than the assumed natural gap disturbance processes.

Flows

Humans (settlement, forestry, recreation, agriculture exploration and development of minerals, oil and gas); water (regulation of water quality and quantity); mainland moose (transient use for seasonal cover / forage, summer temperature regulation); fish (regulation of water quality and quantity, food supply); sediment (potential source of inland sediment).

Composition

St. Georges Bay Ecodistrict 520 (based on statistics up to 2006)
Composition of Floodplain

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	45%	16%	39% (26 Mat + 13 OF)	13%
Seral Stage	Early	Mid	Late	Unclassified
	58%	12%	9%	21%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	50%	11%	32%	7%

Desired Condition

Well-drained portions of this element tending toward ash, sugar maple, and elm through gap type disturbance. On poorer drained areas, edaphic vegetation types of black spruce, eastern larch, and red maple.

Coastal Beach
(Patch) (XXCB ecosection) (497 ha)

Sand beaches derived from eroded sedimentary rock exposed along the shoreline. Pomquet Beach and Dunns Beach, the two largest of these beach areas, are associated with submerged river estuaries that form Antigonish and Pomquet harbours.

Flows

Humans (recreation); sediment (sediment deposits associated with beach formation).

Composition

St. Georges Bay Ecodistrict 520 (based on statistics up to 2006)
Composition of Coastal Beach

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	19%	59%	22% (12 Mat + 10 OF)	10%
Seral Stage	Early	Mid	Late	Unclassified
	69%	8%	21%	2%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	71%	5%	23%	1%

Desired Condition

Natural beach systems with a minimum of human intervention related to development, sediment flow, and near shore water flow.

Wetlands
(Patch) (WTLD ecosection) (221 ha)

Wetlands are relatively uncommon in this ecodistrict. Current forest conditions associated with these wetlands consists primarily of stands in the establishment to young class with predominately early seral vegetation types.

Flows

Humans (recreation, exploration and development of minerals, oil and gas); water (regulation of water quality and quantity); mainland moose (transient use for seasonal cover / forage, summer temperature regulation); fish (regulation of water quality and quantity, food supply).

Composition

St. Georges Bay Ecodistrict 520 (based on statistics up to 2006)
Composition of Wetlands

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	42%	13%	45% (29 Mat + 16 OF)	16%
Seral Stage	Early	Mid	Late	Unclassified
	62%	2%	14%	22%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	35%	13%	49%	3%

Desired Condition

Adjoining natural forest cover and adequate associated drainage patterns to accommodate functioning wetlands.

Salt Marsh
(Patch) (XXSM ecosection) (81 ha)

Salt marshes are relatively uncommon along the Northumberland Strait.

Flows

Humans (recreation); fish (habitat, food supply); sediment (sediment deposits associated with salt marshes).

Composition

St. Georges Bay Ecodistrict 520 (based on statistics up to 2006)
Composition of Salt Marsh

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	26%	2%	72% (38 Mat + 34 OF)	34%
Seral Stage	Early	Mid	Late	Unclassified
	82%	5%	13%	0%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	19%	12%	69%	0%

Desired Condition

Salt marsh within the larger context of functioning coastal processes.

Valley Corridors
(Corridor) (Various ecosections) (5,450 ha)

The identified corridors are associated with watercourses. These corridors are made up of a relatively large number of different small ecosections. The current forest cover contains a fairly well-balanced distribution of development and covertype classes. The seral stage distribution contains somewhat more early seral vegetation types than predicted inherent conditions, possible due to high land use activities in some parts of the corridors.

Flows

Humans (forestry, recreation, agriculture, exploration and development of minerals, oil and gas, unconsolidated aggregate); water (channels for water flow); mainland moose (pertains to corridors identified in mainland portion of ecodistrict. With the exception of the James River, the corridors identified provide transient use for seasonal cover / forage, summer temperature regulation. James River corridor provides opportunity for more use at it extends into the adjoining ecodistrict which is identified as mainland moose habitat); fish (food, habitat, travel route, spawning); sediment (supply and transport sediment from inland).

Composition

St. Georges Bay Ecodistrict 520 (based on statistics up to 2006)
Composition of Valley Corridors

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	28%	11%	61% (42 Mat + 19 OF)	19%
Seral Stage	Early	Mid	Late	Unclassified
	55%	20%	16%	14%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	36%	20%	36%	8%

Desired Condition

Continuous natural forest conditions; however, given the ownership and areas of concentrated human activity, this will inevitably result in some corridors having significantly altered land use features.

Ecosystem Issues and Opportunities (All appendices and maps)

Management of the forest resource in the St. Georges Bay Ecodistrict should focus on forest biodiversity conservation across the range of spatial scales. General principles could include maintenance of connectivity, maintenance of landscape heterogeneity, maintenance of stand structural complexity, and maintenance of the integrity of aquatic systems (Lindenmayer and Franklin 2002). Actions taken toward these principles could consider:

- Extensive and continuous land use coupled with a large number of small private landowners presents a significant challenge with regard to implementing ecosystem level management approaches.
- Maintain a balance between the four ecological emphasis classes, attempting to keep EEI above 50.
- Subject to ownership constraints, enhance connectivity of the corridor elements by maintaining and, where required, restoring natural forest conditions.
- The management of forest communities in relation to the natural disturbance regimes (NDR), development class, and seral stages will face planning and economic challenges given the land ownership pattern.
- Land use has tended to reduce the extent of the identified tolerant hardwood matrix with replacement by earl to mid-seral vegetation types. In addition, there has been a shift from a forest dominated by hardwood covertypes to one with over 50% of the forested land classified as softwood.

Appendix 1: Flow - Element Interactions

Element	Humans	Water	Mainland Moose	Fish (trout and sea run fish)	Sediment (as related to estuaries and coast)
Matrix	settlements, transportation, forestry, recreation, agriculture, exploration and development of minerals, oil and gas	regulation of water quality and quantity	cover and forage	regulation of water quality and quantity	supplies some of the coastal and inland sediment
Corridors Lakevale	forestry, recreation, exploration and development of minerals / oil and gas	channels for water flow	seasonal cover/ forage, summer temperature regulation	food, habitat, travel route, spawning	supply and transport sediment from inland
Wrights River	forestry, recreation, agriculture, exploration and development of minerals / oil and gas	channels for water flow	seasonal cover/ forage, summer temperature regulation but to lesser extent than the section of this corridor in Ecodistrict 330	food, habitat, travel route, spawning	supply and transport sediment from inland
James River	forestry, recreation, agriculture, exploration and development of minerals / oil and gas, unconsolidated aggregate	channels for water flow	seasonal cover/ forage, summer temperature regulation but to lesser extent than the section of this corridor in Ecodistrict 330	food, habitat, travel route, spawning	supply and transport sediment from inland
Ohio / West River	forestry, recreation, transportation, agriculture, exploration and development of minerals / oil and gas, unconsolidated aggregate	channels for water flow	transient use for seasonal cover/ forage, summer temperature regulation	food, habitat, travel route, spawning	supply and transport sediment from inland
South River	forestry, recreation, transportation, agriculture, exploration and development of minerals / oil and gas, unconsolidated aggregate	channels for water flow	transient use for seasonal cover/ forage, summer temperature regulation	food, habitat, travel route, spawning	supply and transport sediment from inland
Pomquet	forestry, recreation, agriculture, exploration and development of minerals / oil and gas, unconsolidated aggregate	channels for water flow	transient use for seasonal cover/ forage, summer temperature regulation	food, habitat, travel route, spawning	supply and transport sediment from inland
Tracadie	forestry, recreation, exploration and development of minerals / oil and gas, unconsolidated aggregate	channels for water flow	transient use for seasonal cover/ forage, summer temperature regulation	food, habitat, travel route, spawning	supply and transport sediment from inland

Appendix 1: Flow - Element Interactions

Element	Humans	Water	Mainland Moose	Fish (trout and sea run fish)	Sediment (as related to estuaries and coast)
Corridors Creignish	forestry, recreation, exploration and development of minerals / oil and gas	channels for water flow	N/A	food, habitat, travel route, spawning	supply and transport sediment from inland
Rory Brook	forestry, recreation, exploration and development of minerals / oil and gas	channels for water flow	N/A	food, habitat, travel route, spawning	supply and transport sediment from inland
Judique Ponds	forestry, recreation, exploration and development of minerals / oil and gas	channels for water flow	N/A	food, habitat, travel route, spawning	supply and transport sediment from inland
Captains Brook	forestry, recreation, exploration and development of minerals / oil and gas	channels for water flow	N/A	food, habitat, travel route, spawning	supply and transport sediment from inland
Patches Spruce Pine Hummocks	forestry, recreation, exploration and development of minerals / oil and gas	regulation of water quality and quantity	Mainland portion of element, preferred moose habitat within ecodistrict, contains potential calving sites	regulation of water quality and quantity, food supply	potential source of inland sediment
Spruce Fir Hills and Hummocks	settlement, forestry, recreation, agriculture exploration and development of minerals / oil and gas	regulation of water quality and quantity	Mainland portion of element, similar use as with black spruce element less calving areas	regulation of water quality and quantity, food supply	potential source of inland sediment
Wetlands	recreation, exploration and development of minerals / oil and gas	regulation of water quality and quantity	transient use for seasonal cover/ forage, summer temperature regulation	regulation of water quality and quantity, food supply	
Salt Marsh	recreation			habitat, food supply	sediment deposits associated with salt marshes
Coastal Beach	recreation				sediment deposits associated with beach
Estuaries	recreation, commercial fishery			habitat, food supply	deposition of inland sediment

Appendix 2a: Landscape Connectivity Worksheet

Feature	Structure Type (corridor, matrix, patch, island)	Importance in Ecodistrict (high, moderate, low)	Significant Cases (species, ecosections, specific rivers)	Scale and Pattern of Operation (local, landscape)	Associated Natural Disturbance Regime	Characteristic Community	Characteristic Neighbour(s)	Barriers - Impediments to Functionality	Significant Issues	Management Strategy
Extent and duration of land use	Matrix	High	Entire Matrix	Landscape	Gap	Early tA, ltA, rM, wB, bF, Abandoned farmland wS Mid rM, yB, sM, wA Late sM, yB, wA, Be	Most prominent within mainland portion of ecodistrict, bounds and/or surrounds all identified ecodistrict elements. Is the most common boundary with adjoining mainland ecodistricts. Sections of matrix bound on St. Georges Bay.	Converted land use, fields, settlements, roads. Higher percentage of early seral communities than indicated in the suggested ranges of seral class distributions for these ecosections.	High level / duration of land use disturbances. Fragmented ownership, extensive road network with little to no non-roaded areas. Shorter rotations than would occur with natural disturbances. Tolerant swd generally lacking over much of ecodistrict.	Encourage forest management that moves forest composition toward that recommended for the respective ecosections. Consideration of access issues related to land use.
Disjunctive portions of matrix from Ecodistrict 330	Island	Low	Fairmount and North Grant	Local mainland portion of ecodistrict	Gap	Early wS, bF, rM, wB, tA Mid rM, yB, sM, wA Late sM, yB, Be, (wA)	On the northern side separates a predominately bS area from the majority of the mainland portion of the ecodistrict. On the southern side predominately bounds on the matrix.	Converted land use, fields, settlements, roads. Higher percentage of early seral communities than indicated in the suggested ranges of seral distributions.	High level / duration of land use disturbances. Fragmented ownership, extensive road network with little to no non-roaded areas. Shorter rotations than would occur with natural disturbances.	Encourage forest management that moves forest composition toward that recommended for the respective ecosections.
Salt Marsh	Patch	High	Antigonish Landing Tracadie Harbour	Local	Storms / wave action	Salt tolerant plant species	estuaries, black spruce ecosections, matrix ecosections	Waterflow obstructions (fresh and salt water). Alteration / development of marsh and adjoining habitat. Sedimentation, water quality.	Development adjacent to marshes. Inland land uses leading to pollution and sediment deposition.	Protection of salt marshes, restoration / enhancement

Appendix 2a: Landscape Connectivity Worksheet

Feature	Structure Type (corridor, matrix, patch, island)	Importance in Ecodistrict (high, moderate, low)	Significant Cases (species, ecosections, specific rivers)	Scale and Pattern of Operation (local, landscape)	Associated Natural Disturbance Regime	Characteristic Community	Characteristic Neighbour(s)	Barriers - Impediments to Functionality	Significant Issues	Management Strategy
Coastal Beach	Patch	High	Mahoneys, Dunns, and Pomquet beaches	Local	Storms / wave action	Salt tolerant coastal plants, dune systems	estuaries, St. Georges Bay	Disturbance, development / alterations of coastal sediment erosion and movement (shoreline protection)	ATV and vehicle use, development, ownership	Protected beaches, stewardship programs
Estuaries	Island	High	Antigonish Harbour, Pomquet Harbour, Little Judique	Landscape	Storms / wave action	Salt to brackish marine flora / fauna	Salt marsh, coastal beaches, matrix ecosections, black spruce ecosections, corridors	Waterflow obstructions (fresh and salt water). Disturbance, development / alterations of coastal sediment creation and movement (shoreline protection). Inland sediment deposition.	Adjacent development / intensive land use. Inland development / intensive land use leading to pollution and inland sediment deposition.	Planned adjacent development, consideration of inland land uses and their effects on estuaries.
Strait of Canso				Landscape			St. Georges Bay	Canso Causeway altering water flow within St. Georges Bay.	Barrier to ice flow, potential alteration of coastal erosion and sediment flow.	

Appendix 2a: Landscape Connectivity Worksheet

Feature	Structure Type (corridor, matrix, patch, island)	Importance in Ecodistrict (high, moderate, low)	Significant Cases (species, ecosections, specific rivers)	Scale and Pattern of Operation (local, landscape)	Associated Natural Disturbance Regime	Characteristic Community	Characteristic Neighbour(s)	Barriers - Impediments to Functionality	Significant Issues	Management Strategy
Valley Corridors	Corridors	High	Ohio/West River, South River	Landscape	Mainly gap	Early rM, bF, wS Mid bF, rS, yB,	Mainly the matrix ecosections with lesser amounts of black spruce ecosections.	Converted land use, fields, settlements, roads. Higher percentage of early seral communities than indicated in the suggested ranges of seral class distributions for these ecosections.	High level / duration of land use disturbances. Interrupted forest cover (fields' roads) and shorter rotations than would occur with natural disturbances. Fragmented ownership	Understand the potential for addressing connectivity issues within the corridors. Plan, and where possible, implement land developments to minimize dissection of corridors. Encourage forestry and land use that maintains continuity of forest cover.

Appendix 2b: Connective Management Strategies

Structure Type	Attributes	Conditions of Concern	Management Strategies
Matrix	percolation, large patch, interior habitat	fragmentation, excessive edge	1. Promote contiguous forest structure using strategies such as patch aggregation and overstory-sustaining selection cutting 2. Promote large patch structure and interior conditions 3. Mitigate large scale, long term, fragmentation of the matrix that could impede percolation 4. Manage age and structure appropriate to NDR. For gap and infrequently disturbed ecosections maintain 60% mature cover
Patch Ecosystems	patch size, nearest neighbour, edge / interior, intervening habitat condition	undesirable connections, internal composition, excessive separations, threats to key patch	1. Identify and map keypatch representatives (high quality, or critical link/distance) 2. Maintain natural isolations, as well as necessary "nearest neighbour" distances 3. Identify potential metapopulation habitat dynamics (if applicable)
Linear Corridors	continuous connection	barriers, interruptions, excessive edge	1. Mitigate unnatural barriers 2. Map and Manage along natural boundaries 3. Conserve "interior" conditions where appropriate through strategic management of neighbouring ecosystems 4. Sustain continuity, through management of overstory and interior structure appropriate to NDR 5. Follow habitat regulations for buffer management. Establish wider buffers with natural boundaries along major waterways

Appendix 3: Special Occurrences (Ecodistrict 520)

Table 1a: Species at Risk (species protected by endangered species legislation on all lands)

SPECIES		DESIGNATION		
Common Name	**Scientific Name**	**Provincial**	**Federal**	**COSEWIC**
BIRDS	-			
Red Knot rufa ssp	*Calidris canutus rufa*	Endangered	N/A	Endangered
Chimney Swift	*Chaetura pelagica*	Endangered	Threatened	Threatened
Piping Plover melodus ssp	*Charadrius melodus melodus*	Endangered	Endangered	Endangered
Common Nighthawk	*Chordeiles minor*	Threatened	Threatened	Threatened
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Threatened	Threatened
Eastern Wood-Pewee	*Contopus virens*	Vulnerable	N/A	Special Concern
Bobolink	*Dolichonyx oryzivorus*	Vulnerable	N/A	Threatened
Barn Swallow	*Hirundo rustica*	Endangered	N/A	Threatened
Bank Swallow	*Riparia riparia*	N/A	N/A	Threatened
Canada Warbler	*Wilsonia canadensis*	Endangered	Threatened	Threatened
DICOTS	-			
Black Ash	*Fraxinus nigra*	Threatened	N/A	N/A
FISH				
American Eel	*Anguilla rostrate*	N/A	Threatened	Threatened
Striped Bass- Southern Gulf of St Lawrence population	*Morone saxatilis pop. 1*	N/A	N/A	Special Concern
INSECTS	-			
Monarch	*Danaus plexippus*	N/A	Special Concern	Special Concern
MAMMALS	-			
Moose	*Alces americanus*	Endangered	N/A	N/A
REPTILES	-			
Snapping Turtle	*Chelydra serpentina*	Vulnerable	Special Concern	Special Concern
Wood Turtle	*Glyptemys insculpta*	Threatened	Threatened	Threatened

Appendix 3: Special Occurrences (Ecodistrict 520)

Table 1b: Other Species of Conservation Concern (other species that are a priority for planning, management, and stewardship action)

SPECIES		DESIGNATION	
Common Name	**Scientific Name**	**Provincial General Status Rank**	**ACCDC S-Rank***
BIRDS	-		
Northern Goshawk	*Accipiter gentilis*	Secure (Green)	S3S4
Spotted Sandpiper	*Actitis macularius*	Sensitive (Yellow)	S3S4B
Northern Pintail	*Anas acuta*	May Be At Risk (Orange)	S2B
Blue-winged Teal	*Anas discors*	May Be At Risk (Orange)	S3B
American Bittern	*Botaurus lentiginosus*	Sensitive (Yellow)	S3S4B
Least Sandpiper	*Calidris minutilla*	Secure (Green)	S1B,S5M
Semipalmated Sandpiper	*Calidris pusilla*	Sensitive (Yellow)	S3M
Pine Siskin	*Carduelis pinus*	Sensitive (Yellow)	S3S4B,S5N
Black Guillemot	*Cepphus grylle*	Secure (Green)	S3S4
Semipalmated Plover	*Charadrius semipalmatus*	Secure (Green)	S1S2B,S5M
Killdeer	*Charadrius vociferus*	Sensitive (Yellow)	S3S4B
Bay-breasted Warbler	*Dendroica castanea*	Sensitive (Yellow)	S3S4B
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Sensitive (Yellow)	S3S4B
Wilson's Snipe	*Gallinago delicata*	Sensitive (Yellow)	S3S4B
Common Loon	*Gavia immer*	May Be At Risk (Orange)	S3B,S4N
Hudsonian Godwit	*Limosa haemastica*	Sensitive (Yellow)	S3M
Northern Gannet	*Morus bassanus*	Secure (Green)	SHB,S5M
Hudsonian Whimbrel	*Numenius phaeopus hudsonicus*	Sensitive (Yellow)	S3M
Fox Sparrow	*Passerella iliaca*	Secure (Green)	S3S4B
Gray Jay	*Perisoreus canadensis*	Sensitive (Yellow)	S3S4
Cliff Swallow	*Petrochelidon pyrrhonota*	May Be At Risk (Orange)	S3B
Great Cormorant	*Phalacrocorax carbo*	Sensitive (Yellow)	S3
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Sensitive (Yellow)	S3S4B
American Golden-Plover	*Pluvialis dominica*	Sensitive (Yellow)	S3M
Boreal Chickadee	*Poecile hudsonica*	Sensitive (Yellow)	S3
Eastern Phoebe	*Sayornis phoebe*	Sensitive (Yellow)	S3S4B
Common Tern	*Sterna hirundo*	Sensitive (Yellow)	S3B
Arctic Tern	*Sterna paradisaea*	May Be At Risk (Orange)	S3B
Greater Yellowlegs	*Tringa melanoleuca*	Sensitive (Yellow)	S3B,S5M
Willet	*Tringa semipalmata*	May Be At Risk(Orange)	S2S3B
Solitary Sandpiper	*Tringa solitaria*	Secure (Green)	S1?B,S4S5M
Tennessee Warbler	*Vermivora peregrina*	Sensitive (Yellow)	S3S4B
DICOTS			
White Snakeroot	*Ageratina altissima*	May Be At Risk (Orange)	S1
Hooked Agrimony	*Agrimonia gryposepala*	Secure (Green)	S3

Appendix 3: Special Occurrences (Ecodistrict 520)

Table 1b: Other Species of Conservation Concern (other species that are a priority for planning, management, and stewardship action)

SPECIES		DESIGNATION	
Common Name	**Scientific Name**	**Provincial General Status Rank**	**ACCDC S-Rank***
Canada Anemone	*Anemone canadensis*	May Be At Risk (Orange)	S2
Virginia Anemone	*Anemone virginiana*	May Be At Risk (Orange)	S2
Estuary Beggarticks	*Bidens hyperborea*	May Be At Risk (Orange)	S1
Marsh Bellflower	*Campanula aparinoides*	Sensitive (Yellow)	S3
Blue Cohosh	*Caulophyllum thalictroides*	May Be At Risk (Orange)	S2
Seaside Spurge	*Chamaesyce polygonifolia*	Secure (Green)	S3
Bastard's Toadflax	*Comandra umbellata*	May Be At Risk (Orange)	S2
Buttonbush Dodder	*Cuscuta cephalanthi*	May Be At Risk (Orange)	S1
Purple-veined Willowherb	*Epilobium coloratum*	Sensitive (Yellow)	S2?
Hyssop-leaved Fleabane	*Erigeron hyssopifolius*	Sensitive (Yellow)	S3
False Mermaidweed	*Floerkea proserpinacoides*	Sensitive (Yellow)	S2
Woolly Beach-heath	*Hudsonia tomentosa*	May Be At Risk (Orange)	S1
Canada Wood Nettle	*Laportea canadensis*	Sensitive (Yellow)	S3
Water Beggarticks	*Megalodonta beckii*	Sensitive (Yellow)	S3
Balsam Groundsel	*Packera paupercula*	Secure (Green)	S3
Pennsylvania Smartweed	*Polygonum pensylvanicum*	Secure (Green)	S3
Sharp-fruited Knotweed	*Polygonum raii*	Undetermined	S2S3
Eastern Cudweed	*Pseudognaphalium obtusifolium*	Secure (Green)	S3S4
Gmelin's Water Buttercup	*Ranunculus gmelinii*	Secure (Green)	S3
Seaside Brookweed	*Samolus valerandi ssp. parviflorus*	Sensitive (Yellow)	S2
Bloodroot	*Sanguinaria canadensis*	Secure (Green)	S3S4
Soapberry	*Shepherdia canadensis*	Sensitive (Yellow)	S2
White Sea-blite	*Suaeda maritima ssp. richii*	Undetermined	S1
Canada Germander	*Teucrium canadense*	Sensitive (Yellow)	S3
Orange-fruited Tinker's Weed	*Triosteum aurantiacum*	Sensitive (Yellow)	S2
Humped Bladderwort	*Utricularia gibba*	Secure (Green)	S3S4
Blue Vervain	*Verbena hastata*	Secure (Green)	S3
Golden Alexanders	*Zizia aurea*	May Be At Risk (Orange)	S1
FERNS AND THEIR ALLIES			
Bulblet Bladder Fern	*Cystopteris bulbifera*	Secure (Green)	S3S4
Common Scouring-rush	*Equisetum hyemale var. affine*	Secure (Green)	S3S4
FISH			
Atlantic Salmon	*Salmo salar*	May Be At Risk (Orange)	S2

Appendix 3: Special Occurrences (Ecodistrict 520)

Table 1b: Other Species of Conservation Concern (other species that are a priority for planning, management, and stewardship action)

SPECIES		DESIGNATION	
Common Name	**Scientific Name**	**Provincial General Status Rank**	**ACCDC S-Rank***
INSECTS			
Hoary Elfin Juvenal's	*Callophrys polios*	Secure (Green)	S3S4
Duskywing	*Erynnis juvenalis*	Secure (Green)	S2S3
Baltimore Checkerspot	*Euphydryas phaeton*	Secure (Green)	S3
Common Branded Skipper	*Hesperia comma*	Secure (Green)	S3
Northern Pygmy Clubtail	*Lanthus parvulus*	Secure (Green)	S3
Northern Pearly-Eye	*Lethe anthedon*	Secure (Green)	S3
Riffle Snaketail	*Ophiogomphus carolus*	Secure (Green)	S3
Maine Snaketail	*Ophiogomphus mainensis*	May Be At Risk (Orange)	S1
Mustard White	*Pieris oleracea*	Sensitive (Yellow)	S2
Green Comma	*Polygonia faunus*	Secure (Green)	S3
Question Mark	*Polygonia interrogationis*	Secure (Green)	S3B
Grey Comma	*Polygonia progne*	Secure (Green)	S3S4
Aphrodite Fritillary	*Speyeria aphrodite*	Secure (Green)	S3S4
Black Meadowhawk	*Sympetrum danae*	Sensitive (Yellow)	S3
Northern Cloudywing	*Thorybes pylades*	Sensitive (Yellow)	S2
MAMMALS			
Cougar - Eastern population	*Puma concolor pop. 1*	Undetermined	SH
MOLLUSKS			
Triangle Floater	*Alasmidonta undulata*	Secure (Green)	S2S3
Eastern Lampmussel	*Lampsilis radiata*	Sensitive (Yellow)	S2
MONOCOTS			
Short-awned Foxtail	*Alopecurus aequalis*	Sensitive (Yellow)	S2S3
Foxtail Sedge	*Carex alopecoidea*	May Be At Risk (Orange)	S1
Hidden-scaled Sedge	*Carex cryptolepis*	Secure (Green)	S3?
Bristle-leaved Sedge	*Carex eburnea*	Sensitive (Yellow)	S3
Inflated Narrow-leaved Sedge	*Carex grisea*	May Be At Risk (Orange)	S1
Porcupine Sedge	*Carex hystericina*	May Be At Risk (Orange)	S2
Tender Sedge	*Carex tenera*	Sensitive (Yellow)	S1S2
Tinged Sedge	*Carex tincta*	May Be At Risk (Orange)	S1
Estuarine Sedge	*Carex vacillans*	Undetermined	S1S3
Hop Flatsedge	*Cyperus lupulinus ssp. macilentus*	May Be At Risk (Orange)	S1
Yellow Lady's-slipper	*Cypripedium parviflorum*	Sensitive (Yellow)	S2S3

Appendix 3: Special Occurrences (Ecodistrict 520)

Table 1b: Other Species of Conservation Concern (other species that are a priority for planning, management, and stewardship action)

SPECIES		DESIGNATION	
Common Name	**Scientific Name**	**Provincial General Status Rank**	**ACCDC S-Rank***
Showy Lady's-Slipper	*Cypripedium reginae*	May Be At Risk (Orange)	S2
Yellow Spikerush	*Eleocharis olivacea*	Sensitive (Yellow)	S2S3
Greene's Rush	*Juncus greenei*	May Be At Risk(Orange)	S1S2
Canada Lily	*Lilium canadense*	Sensitive (Yellow)	S2S3
Large Purple Fringed Orchid	*Platanthera grandiflora*	Secure (Green)	S3
Blunt-leaved Pondweed	*Potamogeton obtusifolius*	Sensitive (Yellow)	S2S3
White-stemmed Pondweed	*Potamogeton praelongus*	Sensitive (Yellow)	S3?
Olney's Bulrush	*Schoenoplectus americanus*	Sensitive (Yellow)	S3
Stalked Bulrush	*Scirpus pedicellatus*	Undetermined	S1
Narrow-leaved Blue-eyed-grass	*Sisyrinchium angustifolium*	Secure (Green)	S3S4

*Atlantic Canada Conservation Data Centre S-Ranks, where S1: extremely rare; S2: rare; S3: uncommon; S4: usually widespread, fairly common; S5: widespread, abundant; S#S#: A range between two consecutive ranks for a species/community denotes uncertainty about the exact rarity (e.g. S1S2); Consult http://www.accdc.com/en/ranks.html for descriptions of other ranks.

Provincial General Status Ranks as assessed in 2010 (http://www.wildspecies.ca/wildspecies2010).

Appendix 3: Special Occurrences (Ecodistrict 520)
Table 1c – Other Conservation Features

Feature	Type	Information Source	Legislation or Status Ranking System
Deer wintering areas (DWA)	Forest habitat	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	
Bat hibernacula	Caves and mine adits	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Nova Scotia Wildlife Act; Nova Scotia Endangered Species Act
Loon nesting lakes	Freshwater lakes	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Migratory Birds Convention Act
Eagle nesting areas	Forest habitat	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Nova Scotia Wildlife Act
Osprey nesting areas	Forest habitat	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Nova Scotia Wildlife Act
Hawk and owl nesting areas	Forest habitat	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Nova Scotia Wildlife Act
Waterfowl breeding, staging, and wintering areas	Freshwater wetlands, salt marshes, and coastal waters	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Migratory Birds Convention Act
Seabird nesting colonies	Coastal headlands, cliffs, and islands	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Migratory Birds Convention Act
Shorebird breeding and staging areas	Beaches, salt marshes, and mudflats	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Migratory Birds Convention Act

Appendix 3: Special Occurrences (Ecodistrict 520)
Table 1c – Other Conservation Features

Feature	Type	Information Source	Legislation or Status Ranking System
Piping plover nesting areas	Beaches and dunes	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Nova Scotia Wildlife Act; Nova Scotia Endangered Species Act
Great blue heron rookeries	Forest habitat	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Migratory Birds Convention Act
Wood turtle habitat	Rivers, streams, and riparian habitat	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Nova Scotia Wildlife Act; Nova Scotia Endangered Species Act
Fish habitat areas	Rivers, streams, and lakes	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Canada Fisheries Act
Dragonfly, damselfly, and butterfly habitats	Upland and wetland habitats	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Nova Scotia Endangered Species Act
Freshwater mussel habitat	Rivers, streams, and lakes	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Nova Scotia Endangered Species Act
Rare plant habitat	Upland and wetland habitats	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	Nova Scotia Endangered Species Act
NSDNR Old Forest Reserves	Old forest habitat	Old Forest Database	Policy reserve
Eastern Habitat Joint Venture Lands	Habitat	DNR Restricted Land Use Database	Legal Agreement
Ducks Unlimited Projects	Wetlands	Significant Habitats of Nova Scotia Database	Legal agreement

Appendix 3: Special Occurrences (Ecodistrict 520)
Table 1c – Other Conservation Features

Feature	Type	Information Source	Legislation or Status Ranking System
Karst areas	Upland and wetland sites	Significant Habitats of Nova Scotia Database; Atlantic Canada Conservation Data Centre database	N/A
Provincial Wildlife Management Areas	Provincial Wildlife Management Area	DNR Restricted Land Use Database	Nova Scotia Wildlife Act
Nature Reserves	Ecosystem	DNR Restricted Land Use Database	Special Places Protection Act
Provincial Parks	Ecosystem /recreation	DNR Restricted Land Use Database	Nova Scotia Parks Act
Operational/Non-Designated Parks and Reserves	Ecosystem /recreation	DNR Restricted Land Use Database	Nova Scotia Parks Act
Protected Beaches	Ecosystem	DNR Restricted Land Use Database	Nova Scotia Beaches Protection Act
Designated Water Supply Areas	Designated Water Supply Area	DNR Restricted Land Use Database	Nova Scotia Environment Act
Non-Designated Water Supply Areas	Non-Designated Water Supply Area	DNR Restricted Land Use Database	Nova Scotia Environment Act
Important Bird Areas Coastal Island	Ecosystem Ecosystem	Bird Studies Canada Significant Habitats of Nova Scotia Database	
Nature Conservancy of Canada site	Ecosystem	Nature Conservancy ofCanada	Legal Agreement
Estuaries	Freshwater wetlands, salt marshes, and coastal waters	Significant Habitats of Nova Scotia Database	

Appendix 3: Special Occurrences (Ecodistrict 520)
Table 1d – Heritage Features

Feature	Type	Information Source
Aboriginal Burial Grounds –	Cultural/Community Heritage	Aboriginal Traditional Knowledge Local Knowledge
Native Artifacts –	Cultural/Community Heritage	Aboriginal Traditional Knowledge Local Knowledge
First Nations Reserve Lands – Paqtnkek	Cultural	NSDNR Restricted Land Use Database
Significant Geological Feature – Prograded Dunes	Geological and Cultural Heritage	Local Knowledge

Appendix 3: Special Occurrences

Table 2: Comparison of Ecological Emphasis Classification Index by Ecosection (Within Ecodistrict and Ecoregion)

Ecosections that form 2% or less of the ecodistrict and/or ecoregion area or are more than 75% converted are highlighted. The table provides a sense of how unique or uncommon an ecosection and its associated climax communities are within the ecodistrict and across the ecoregion. The EEC Index value conveys an indication of relative land use pressure on the ecosection.

Ecosection	Climax Type	Ecodistrict Occurrence						Ecoregion Occurrence					
		Area of Ecosection		Area of Climax Type (1, 2, 3) *		EEC Index ecosection	% Converted	Area of Ecosection		Area of Climax Type (1, 2, 3) *		EEC Index ecosection	% Converted
		Ha	%	Ha	%			Ha	%	Ha	%		
ICHO	bS wP	1,541	0.0	17,714	0.2	35 to 40	0.3	55,664.9	0.1	234,959.1	0.3	60 to 68	0.1
IFHO	bS	9,274	0.1	16,726	0.2	50 to 58	0.1	80,337.9	0.1	98,072.8	0.1	53 to 59	0.2
IFKK	bS wP	7,108	0.1	17,714	0.2	37 to 45	0.2	22,278.8	0.0	234,959.1	0.3	47 to 55	0.2
IFSM	aE sM wA	5,255	0.1	3,702	0.0	32 to 37	0.4	10,330.6	0.0	8,936.6	0.0	44 to 49	0.3
IMHO	bS wP	435	0.0	17,714	0.2	41 to 51	0.3	163,102.7	0.2	234,959.1	0.3	56 to 63	0.1
IMSM	bS	161	0.0	16,726	0.2	50 to 54	0.3	12,116.2	0.0	98,072.8	0.1	52 to 57	0.2
PFHO	bS	57	0.0	16,726	0.2	54.0	0.3	57.1	0.0	98,072.8	0.1	54	0.3
WCHO	bS wP	3,692	0.0	17,714	0.2	33 to 39	0.3	53,699.5	0.1	234,959	0.3	50 to 56	0.2
WCKK	sM yB Be	2,988	0.0	43,634	0.5	25 to 32	0.4	45,025.0	0.1	205,110	0.2	54 to 62	0.1
WCRD	bS wP	140	0.0	17,714	0.2	56 to 61	0.0	6,331	0.0	234,959	0	64 to 69	0
WCSM	aE sM wA	166	0.0	3,702	0.0	37 to 50	0.2	2,190	0.0	8,937	0	40 to 46	0
WFHO	sM yB Be	8,199	0.1	43,634	0.5	40 to 49	0.2	18,773	0.0	205,110	0	46 to 52	0
WFKK	sM yB Be	37,437	0.4	43,634	0.5	37 to 48	0.2	70,719	0.1	205,110	0	43 to 51	0
WFSM	aE sM wA	1,370	0.0	3,702	0.0	30 to 35	0.4	1,370	0.0	8,937	0	30 to 35	0
WMDM	sM yB Be	204	0.0	43,634	0.5	58 to 65	0.1	27,710	0.0	205,110	0	59 to 65	0
WMDS	sM yB Be	272	0.0	43,634	0.5	38 to 40	0.3	272	0.0	205,110	0	38 to 40	0
WMHO	bS wP	4,798	0.1	17,714	0.2	40 to 44	0.3	78,353	0.1	234,959	0	43 to 48	0
WMKK	sM yB Be	4,481	0.1	43,634	0.5	35 to 41	0.3	75,415	0.1	205,110	0	47 to 54	0
WTLD	wetlands	220	0.0	0	0.0	65 to 71	0.0	13,729	0.0	0	0	70 to 73	0

*Area of Climax Type refers to the total area of the climax community in the ecodistrict and in the ecoregion.

Appendix 4: Ecological Representivity Worksheet

Ecosystem			Crown Responsibility	Legal Reserve (IUCN I, II, III)		Policy Reserves (including unproclaimed legal reserve proposals)		Ecological Emphasis Classification "Reserve Class"					
Ecosection	Climax Type	Area (ha)	Percent of Area on Crown (%)	Crown Area (ha)	Private Area (ha)	Crown Area (ha)	Private Area (ha)	Crown		Private		Total Reserve	
								ha	% (EcoS)	ha	% (EcoS)	ha	% (EcoS)
WFKK	sM yB Be	37,437	0.1	0	7	110	0	110	0.0	7	0.0	117	0.0
IFHO	bS	9,274	0.1	0	0	82	0	82	0.0	0	0.0	82	0.0
WFHO	sM yB Be	8,199	0.0	24	5	145	0	169	0.0	5	0.0	174	0.0
IFKK	bS wP	7,108	0.0	0	0	12	0	12	0.0	0	0.0	12	0.0
IFSM	aE sM wA	5,255	0.0	0	0	6	0	6	0.0	0	0.0	6	0.0
WMHO	bS wP	4,798	0.0	95	133	53	0	149	0.0	133	2.8	282	0.1
WMKK	sM yB Be	4,481	0.1	0	14	84	0	84	0.0	14	0.3	98	0.0
WCHO	bS wP	3,692	0.0	0	0	7	0	7	0.0	0	0.0	7	0.0
WCKK	sM yB Be	2,988	0.0	0	0	10	0	10	0.0	0	0.0	10	0.0
ICHO	bS wP	1,541	0.0	0	0	4	0	4	0.0	0	0.0	4	0.0
WFSM	aE sM wA	1,370	0.0	0	0	2	0	2	0.0	0	0.0	2	0.0
XXWA	NONE	809	0.0	0	0	0	0	0	0.0	0	0.0	0	0.0
XXCB	coastal beach	497	0.4	201	86	3	0	203	0.4	86	17.4	290	0.6
IMHO	bS wP	435	0.0	0	0	0	0	0	0.0	0	0.0	0	0.0
WMDS	sM yB Be	272	0.0	0	0	5	0	5	0.0	0	0.0	5	0.0
WTLD	wetlands	220	0.3	0	0	0	0	0	0.0	0	0.0	0	0.0
WMDM	sM yB Be	204	0.0	0	1	0	0	0	0.0	1	0.4	1	0.0
XXMS	salt marsh	191	0.0	0	0	1	0	1	0.0	0	0.0	1	0.0
WCSM	aE sM wA	166	0.0	0	0	0	0	0	0.0	0	0.0	0	0.0
IMSM	bS	161	0.0	0	0	0	0	0	0.0	0	0.0	0	0.0
WCRD	bS wP	140	0.0	0	0	27	0	27	0.0	0	0.0	27	0.0
PFHO	bS	57	0.0	0	0	0	0	0	0.0	0	0.0	0	0.0
Total		**89,295**		**320**	**246**	**552**	**0**	**872**		**246**		**1,084**	

See Appendix 12b for full Ecological Emphasis worksheet.

Appendix 5: Ecodistrict Reserves and Protected Areas Summary

Legal Reserves			Policy Reserves (including unproclaimed legal proposals)		
Act Designation	Area by Ownership		Policy Program	Area by Ownership	
	Crown (ha)	Private (ha)		Crown (ha)	Private (ha)
Protected Beaches	278	235	Operational Non Designated Parks and Reserves	159	0
Operational Non Designated Parks and Reserves	299	0	Old Forest	379	0
Sites of Ecological Significance Under Moratorium	176	0	Designated Provincial Parks and Park Reserves	4	0
Nature Conservancy of Canada	0	11			

Source: Crown Lands Forest Model Landbase Classification
Some of these programs may occur in the same area. For example, much of the Old Forest Policy forests are located in the Wilderness Areas.

Appendix 6: Description of Road Density Index

Road, trail, and utility corridors provide the background structure for transporting people and goods and are integral components of human land use. However, transportation systems are expensive and have a wide range of negative environmental impacts including, water course siltation, habitat fragmentation, dispersal obstruction, plant and animal mortality, exotic species invasion, loss of productive land, and an overall increase in human presence (Forman & Deblinger 2000, Reed et. al. 1996, Lindenmayer & Franklin 2002).

In order to reduce conflicts with natural systems and improve transportation safety there is clearly a need to incorporate landscape ecology into the planning of transportation networks (Forman 2004, Forman & Hersperger 1996, Spellerberg 1998). The emerging science of road ecology advocates integrating spatial analysis of the transportation system with ecological landscape analysis as a fundamental step in transportation system planning (Forman 1999, Lindenmayer & Franklin 2002, Diaz & Apostol 1992).

Efficient access systems can be strategically designed to minimize environmental impacts by incorporating factors such as harvest scheduling, life expectancy, location, road class requirements, decommissioning, and mitigation measures (Lindenmayer & Franklin 2002, Forman, 2004). Selection of transportation routes should incorporate knowledge of landscape functions to improve compatibility with natural ecosystem flows and connectivity (Forman & Hersperger, 1996). Furthermore, areas without roads and/or few roads are important for biodiversity conservation and should be considered during planning (USDA Forest Service 1999).

The GIS based “Road Index” procedure calculates and maps the spatial influence of the transportation network. It is a management tool designed to help planners gauge the relative influence of man-made linear features within landscapes. It was designed to help integrate the transportation system into an ecological landscape analysis process. In addition to mapping, the index provides a numerical indicator of road influence that can be used to monitor temporal changes and compare different landscapes.

Main Concepts

The influence of the transportation network on the ecological landscape varies with three main factors: 1) the type of transportation feature (e.g. highway, power line, trail, etc.); 2) the density of linear features in a given area; and 3) the distance of an area from transportation features (Forman 2004, Lindenmayer & Franklin 2002, Forman & Deblinger 2000). The Road Index is a weighting of these three factors reflecting their relative influence on ecosystem function.

Road density has a well-documented influence on many factors, including wildlife movements, fragmentation, human access, hydrology, and fire patterns (Forman and Hersperger, 1996). Forman & Deblinger (2000) report great variance in road effect zones, with average cumulative effects extending 300 metres from road edges, and some impacts penetrating up to a kilometre. Consequently, Index values are determined by assessing the transportation network within a one kilometre radius. The Index algorithm is applied to a grid of one hectare squares representing the landscape in question. The calculation provides a measure of the density of the transportation network and the specific distance to the transportation features.

The resulting index values are scaled to provide a potential range of 0 to 100. For the purpose of map interpretation these values have been grouped into benchmark ranges that reflect characteristic patterns of land use in Nova Scotia.

In Nova Scotia, as in most populated jurisdictions, transportation networks are continuously changing as new roads and utilities are constructed and unused roads and trails deteriorate. As such, any analysis of the current state of these features must be based on reasonably up-to-date data. In this province, the Geomatics Centre, administered by Service Nova Scotia and Municipal Relations, is responsible for mapping transportation features which they include in their 1:10000 topographic series mapping.

On a provincial level, this work is updated on a ten-year repeat cycle and includes changes to existing features and the delineation of new features. Before undertaking road analysis, the Geomatics Centre should be contacted to ensure that the most current data is used to calculate the Road Index values. This data should be further updated using Landsat satellite imagery to add significant new roads and utilities that are over 500 metres in length on lands currently with a remote or forest resource index value.

DNR Forestry Branch maintains a table relating the topographic series attribute coding used by the Geomatics Centre to the feature categories used in the Road Index calculations, along with ArcView programs allowing the data to be formatted correctly. An inventory of recent Landsat satellite images is also available.

Full report contained in the Ecological Landscape Analysis Guidebook
http://www.gov.ns.ca/natr/library/forestry/reports/Procedural%20Guide%20For%20Ecological%20Landscape%20Analysis.pdf

Appendix 7: Road Density Index Worksheets

Road index values for all tables are benchmarks that will be monitored over time to evaluate trends.

Table 1: Length of Access Systems and Index Weighting for Different Road Types

Road Type	Road Index Weighting	Length (km)
Trails, tracks, abandoned roads, and railways	1	922
Utility corridors	3	184
Gravel roads and active railways	6	1054
Paved streets and roads collectors	10	357
Highways	15	59

Table 2: Distribution of Road Index Classes

Road Index		Area of Ecodistrict Affected	
Indication	Range	Hectares	Percent
Remote	0 to 6	13,139	14.7
Forest Resource	7 to 15	44,300	49.6
Mixed Rural	16 to 24	22,689	25.4
Agriculture Suburban	25 to 39	7,419	8.3
Urban	40 to 100	1,745	2.0
Total		**89,292**	**100**

Table 3: Road Index Values for Each Landscape Element Type

Landscape Element	Area (ha)	Road Index
Valley Corridors	5,450	19.7
Tolerant Hardwood Hills	53,137	7.3
Spruce Pine Hummocks	19,041	8.9
Coastal Beach	497	9.1
Salt Marsh	81	52.7
Floodplain	3,299	10.0
Spruce Fir Hills and Hummocks	6,806	9.0
Wetlands	221	16.5
Total	**88,532**	**9.1**

*Water is excluded from this table. Rounding, overlapping and averaging of figures may lead to small differences in tables.

Appendix 8: Development Classes and Seral Stages

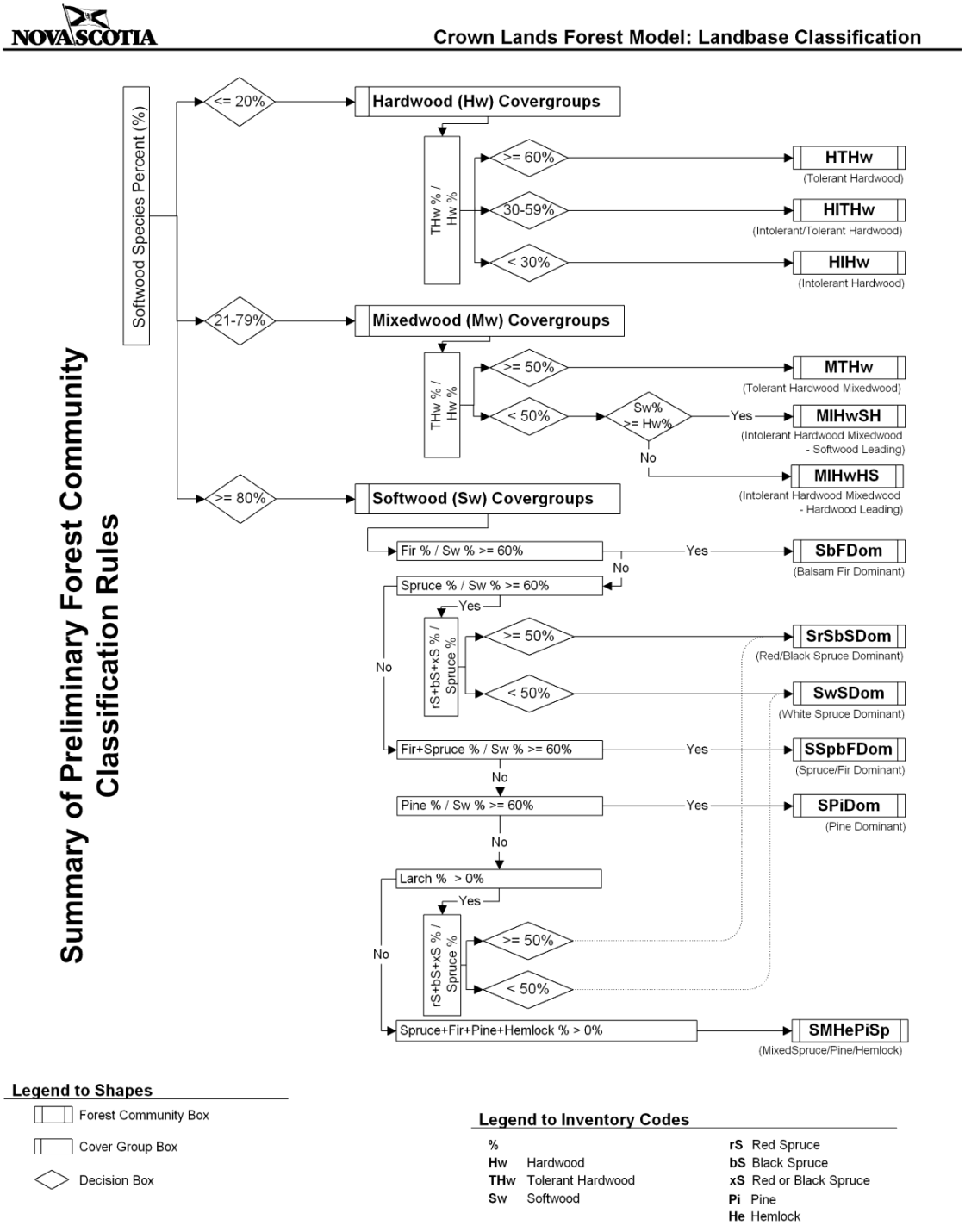
Development Class	Seral Stage
1. Forest Establishment (Height 0 to 6m) • establishment of new growth following a stand-initiating disturbance • high diversity of forbs, shrubs, and tree regeneration, many of which are short-live shade intolerant "pioneer" species • peak seed production by forbs and shrubs • approximate age 0 to 25 years	Early Seral Species (Score 10 to 23) • new growth dominated by pioneer tree species or unclassified regeneration Mid Seral Species (Score 24 to 37) • regeneration composed of a mixture of pioneer, mid-climax, and climax species Late Seral Species (Score 38 to 50) • regeneration dominated by climax species
2. Young Forest (Height 7 to 11 m) • young forests with developing tree canopies characterized by vigorous self-thinning and crown differentiation • early tree seed production, no understory development • approximate age 25 to 40 years	Early Seral Species (Score 10 to 23) • canopy dominated by pioneer tree species Mid Seral Species (Score 24 to 37) • canopy composed of a mixture of pioneer, mid-climax, and climax species Late Seral Species (Score 38 to 50) • canopy dominated by climax species
3. Mature Forest (Height > 11m) • stands dominated by upper canopy with full differentiation into dominance classes • self-thinning process reduced • tree seed production prominent and regular • individual tree mortality creates canopy gaps that are soon closed by neighbouring tree growth • increased light initiates regeneration and early understory development • approximate age 40 to 125 years	Early Seral Species (Score 10 to 23) • canopy dominated by pioneer species • over maturity initiates canopy breakup and understory development Mid Seral Species (Score 24 to 37) • climax species in mixture with pioneers in the overstory • often reflecting a transition to climax domination following a period of sub canopy development Late Seral Species (Score 38 to 50) • canopy dominated by climax species • over maturity initiates gap dynamic processes leading to multi-aged and old growth conditions
4. Multi-aged and old growth forest (Varying height and age and Old Growth ID) • dominant overstory exhibiting a variety of crown sizes and canopy densities • canopy gaps promote development of multi-layered understory and recruitment to overstory	Early Seral Species (Score 10 to 23) • canopy likely to break up and be replaced by developing understory Mid Seral Species (Score 24 to 37) • pioneer-dominated overstory with canopy recruitment from a climax species-dominated understory Late Seral Species (Score 38 to 50) • climax species-dominated overstory maintained through gap dynamic processes

Summary of species-level seral score values by ecodistrict (Source: NSDNR - January 2014 revision)

Species		Ecodistrict																																						
Code	**Name**																																							
AS	ash	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
BA	black ash	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
BC	black cherry	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
BE	beech	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
BF	balsam fir	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	5	5	5	1	1
BP	balsam poplar	1	3	3	3	3	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	3	1
BS	black spruce	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
EC	eastern cedar	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
EH	eastern hemlock	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	exotic species	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GB	grey birch	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IH	intolerant hardwood	3	2	4	2	2	2	2	2	4	2	2	2	2	2	2	2	2	2	2	2	4	3	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2
IW	ironwood	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
JP	jack pine	2	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
LA	largetooth aspen	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OH	other hardwood	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
OS	other softwood	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PC	pin cherry	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RM	red maple	3	2	4	2	2	2	2	2	4	2	5	2	2	2	2	2	2	2	2	2	5	3	2	2	2	2	2	2	2	2	2	3	2	3	3	2	2	2	2
RO	oak	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
RP	red pine	3	3	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3	3	4	4	4	4	4	4	4	3	4	3	3	3	4	4	3	4	4	3	3	3	3
RS	red spruce	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
SM	sugar maple	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
ST	striped maple	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
TA	aspen	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TH	tolerant hardwood	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
TL	eastern larch	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
UC	unclassified	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
WA	white ash	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
WB	white birch	3	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
WE	white elm	2	2	4	2	4	2	2	2	2	2	2	2	2	2	2	2	4	4	4	2	2	2	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2
WP	white pine	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
WS	white spruce	4	4	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	5	5	4	1	1
XS	red and black spruce	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
YB	yellow birch	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

A look-up table assigns each species in the forest inventory a value from one to five for its position on the successional scale. The look-up table may change by ecodistrict since climax on the coast or the Cape Breton Highlands differs from inland and lowland districts. This successional value is multiplied by the species' percent in the stand to give a stand successional score. Each stand may have up to four species, and the four percentages add to 10, so the stand successional scores range from 10 to 50. These scores are subdivided into three successional categories: 10 to 23 early, 24 to 37 mid, and 38 to 50 late.

Appendix 9: Vegetation Community Classification – Forest Model



Appendix 10: Table 1: Forest Landscape Composition Worksheet (St. Georges Bay 520)

Element	Ecosection (% land area)	Covertype	Climax Species (M=Mid; L=Late Seral)	Natural Disturbance Regime	Total Land Area of Potential Forest* (ha; %)	Seral Stage	Current Forest - GIS Inventory							
							Development Class (ha)				Total Forested Area (ha)	Covertype (ha; %)	Seral Stage Summary (ha; %)	
							Establish-ment (1)	Young Forest (2)	Mature Forest (3)	Multi-aged (4)				
Tolerant Hardwood Hills Matrix	WFKK (70.1%) WFHO (15.4%) WMKK (8.4%) WCKK (5.2%) WMDS (0.5%) WMDM (0.4%)	Softwood	bS	Gap	6178; 11.6	Early	2,792	3,181	2,373	998	9,343	18,584; 48.7	EARLY	21,192; 55.5
						Mid	682	482	311	210	1,685			
						Late	2,275	432	540	213	3,460			
						Uncl	4,095	0	0	0	4,095			
		Mixedwood	rS eH sM yB Be	Gap	3723; 7.0	Early	1,690	1,738	2,204	1,254	6,887	10,829; 28.4	MID	5,143; 13.5
						Mid	343	453	910	567	2,272			
						Late	8	24	104	83	218			
						Uncl	1,451	1	0	0	1,452			
		Hardwood	sM yB Be	Gap	43236; 81.4	Early	434	778	1,655	357	3,224	5,384; 14.1	LATE	4,346; 11.4
						Mid	61	90	947	89	1,186			
						Late	12	27	608	22	668			
						Uncl	306	0	0	0	306			
		Unclassified				Early	1,445	86	208	0	1,738	3,398; 8.9	UNCL	7,513; 19.7
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	1,660	0	0	0	1,660			
Total					**53,137***	**# ha**	**17,252**	**7,291**	**9,859**	**3,792**	**38,194**			
						%	**45.2%**	**19.1%**	**25.8%**	**9.9%**	**100.0%**			

Left side of table refers to "potential" forest, interpreted from the Ecological Land Classification. Right side refers to "current" forest condition, summarized from inventory in the Forest Model. All multi-aged stands can be considered mature and added to mature totals. *Total area of element.

Appendix 10: Table 1: Forest Landscape Composition Worksheet (St. Georges Bay 520)

Element	Ecosection (% land area)	Covertype	Climax Species (M=Mid; L=Late Seral)	Natural Disturbance Regime	Total Land Area of Potential Forest* (ha; %)	Seral Stage	Current Forest - GIS Inventory							
							Development Class (ha)				Total Forested Area (ha)	Covertype (ha; %)	Seral Stage Summary (ha; %)	
							Establish-ment (1)	Young Forest (2)	Mature Forest (3)	Multi-aged (4)				
Valley Corridors	IFSM (55.6%) ICHO (9.6%) WFSM (8.3%) WCHO (7.9%) IFKK (5.6%) WCKK (3.9%) WFKK (3.7%) IFHO (1.1%) WMHO (0.6%)	Softwood	bS wP bS	Gap Frequent	1979; 36.3	Early	47	83	188	93	412	761; 36.2	EARLY	1,148; 54.6
						Mid	14	27	21	6	68			
						Late	63	14	53	18	148			
						Uncl	133	0	0	0	133			
		Mixedwood	rS eH sM yB Be	Frequent	20; 0.4	Early	59	50	195	165	469	753; 35.8	MID	416; 19.8
						Mid	9	16	141	46	212			
						Late	0	3	22	6	31			
						Uncl	42	0	0	0	42			
		Hardwood	aE sM wA sM yB Be	Gap frequent	2209; 40.5	Early	32	18	129	38	215	425; 20.2	LATE	242; 11.5
						Mid	20	8	94	15	137			
						Late	0	3	42	17	62			
						Uncl	11	0	0	0	11			
		Unclassified				Early	46	3	4		53	164; 7.8	UNCL	297; 14.1
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	112	0	0	0	0			
Total					**5,450***	**# ha**	**586**	**223**	**890**	**405**	**1,991**			
						%	**29.4%**	**11.2%**	**44.7%**	**20.3%**	**100.0%**			

Left side of table refers to "potential" forest, interpreted from the Ecological Land Classification. Right side refers to "current" forest condition, summarized from inventory in the Forest Model. All multi-aged stands can be considered mature and added to mature totals. *Total area of element.

Appendix 10: Table 1: Forest Landscape Composition Worksheet (St. Georges Bay 520)

Element	Ecosection (% land area)	Covertype	Climax Species (M=Mid; L=Late Seral)	Natural Disturbance Regime	Total Land Area of Potential Forest* (ha; %)	Seral Stage	Current Forest - GIS Inventory							
							Development Class (ha)				Total Forested Area (ha)	Covertype (ha; %)	Seral Stage Summary (ha; %)	
							Establish-ment (1)	Young Forest (2)	Mature Forest (3)	Multi-aged (4)				
Spruce Pine Hummocks	IFHO (48.4%) WMHO (25.0%) WCHO (17.1%) ICHO (5.3%) IMHO (2.3%) IMSM (0.8%) WCRD (0.7%) PFHO (0.3%)	Softwood	bS wP bS	Frequent	18977; 99.7	Early	541	660	640	248	2,089	6,623; 51.9	EARLY	5,447; 42.7
						Mid	271	280	216	152	919			
						Late	631	592	898	279	2,400			
						Uncl	1,216	0	0	0	1,216			
		Mixedwood				Early	711	492	555	295	2,053	3,906; 30.6	MID	2,469; 19.3
						Mid	264	225	485	269	1,243			
						Late	15	33	66	39	152			
						Uncl	458	0	0	0	458			
		Hardwood				Early	288	240	441	140	1,110	1,563; 12.2	LATE	2,621; 20.5
						Mid	32	12	199	65	307			
						Late	1	7	58	4	69			
						Uncl	77	0	0	0	77			
		Unclassified				Early	110	35	50	0	196	666; 5.2	UNCL	2,222; 17.4
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	471	0	0	0	471			
Total					**19,041***	**# ha**	**5,085**	**2,575**	**3,608**	**1,491**	**12,759**			
						%	**39.9%**	**20.2%**	**28.3%**	**11.7%**	**100.0%**			

Left side of table refers to "potential" forest, interpreted from the Ecological Land Classification. Right side refers to "current" forest condition, summarized from inventory in the Forest Model. All multi-aged stands can be considered mature and added to mature totals. *Total area of element.

Appendix 10: Table 1: Forest Landscape Composition Worksheet (St. Georges Bay 520)

Element	Ecosection (% land area)	Covertype	Climax Species (M=Mid; L=Late Seral)	Natural Disturbance Regime	Total Land Area of Potential Forest* (ha; %)	Seral Stage	Current Forest - GIS Inventory							
							Development Class (ha)				Total Forested Area (ha)	Covertype (ha; %)	Seral Stage Summary (ha; %)	
							Establish-ment (1)	Young Forest (2)	Mature Forest (3)	Multi-aged (4)				
Spruce Fir Hills and Hummocks	IFKK (100.0%)	Softwood	bS wP	Gap	6,806	Early	366	275	367	83	1,091	2,882; 58.6	EARLY	2,284; 46.4
						Mid	84	74	107	33	297			
						Late	217	154	417	34	821			
						Uncl	673	0	0	0	673			
		Mixedwood				Early	429	144	165	61	799	1,394; 28.3	MID	751; 15.2
						Mid	59	17	260	57	394			
						Late	1	4	41	7	52			
						Uncl	150	0	0	0	150			
		Hardwood				Early	46	22	146	2	215	339; 6.9	LATE	918; 18.7
						Mid	0	2	49	9	60			
						Late	0	7	38	0	45			
						Uncl	19	0	0	0	19			
		Unclassified				Early	118	23	39	0	180	308; 6.3	UNCL	970; 19.7
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	128	0	0	0	128			
Total					6,806*	**# ha**	**2,289**	**722**	**1,627**	**285**	**4,923**			
						%	**46.5%**	**14.7%**	**33.0%**	**5.8%**	**100.0%**			

Left side of table refers to "potential" forest, interpreted from the Ecological Land Classification. Right side refers to "current" forest condition, summarized from inventory in the Forest Model. All multi-aged stands can be considered mature and added to mature totals. *Total area of element.

Appendix 10: Table 1: Forest Landscape Composition Worksheet (St. Georges Bay 520)

Element	Ecosection (% land area)	Covertype	Climax Species (M=Mid; L=Late Seral)	Natural Disturbance Regime	Total Land Area of Potential Forest* (ha; %)	Seral Stage	Current Forest - GIS Inventory							
							Development Class (ha)				Total Forested Area (ha)	Covertype (ha; %)	Seral Stage Summary (ha; %)	
							Establish-ment (1)	Young Forest (2)	Mature Forest (3)	Multi-aged (4)				
Floodplain	IFSM (67.6%) WFSM (27.8%) WCSM (4.6%)	Softwood	bS	Gap Infrequent	446; 13.5	Early	125	145	175	72	517	946; 50.1	EARLY	1,087; 57.6
						Mid	25	8	20	0	52			
						Late	112	13	18	7	150			
						Uncl	227	0	0	0	227			
		Mixedwood				Early	81	68	140	87	375	603; 32.0	MID	216; 11.5
						Mid	24	25	45	28	121			
						Late	0	6	7	3	16			
						Uncl	90	0	0	0	90			
		Hardwood	aE sM wA	Gap Infrequent	1,863; 56.5	Early	33	26	56	24	140	208; 11.0	LATE	178; 9.4
						Mid	10	5	16	12	43			
						Late	0	0	9	3	12			
						Uncl	14	0	0	0	14			
		Unclassified				Early	41	5	10	0	56	130; 6.9	UNCL	405; 21.5
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	74	0	0	0	74			
Total					**3,299***	**# ha**	**855**	**302**	**493**	**237**	**1,887**			
						%	**45.3%**	**16.0%**	**26.1%**	**12.6%**	**100.0%**			

Left side of table refers to "potential" forest, interpreted from the Ecological Land Classification. Right side refers to "current" forest condition, summarized from inventory in the Forest Model. All multi-aged stands can be considered mature and added to mature totals. *Total area of element.

Appendix 10: Table 1: Forest Landscape Composition Worksheet (St. Georges Bay 520)

Element	Ecosection (% land area)	Covertype	Climax Species (M=Mid; L=Late Seral)	Natural Disturbance Regime	Total Land Area of Potential Forest* (ha; %)	Seral Stage	Current Forest - GIS Inventory							
							Development Class (ha)				Total Forested Area (ha)	Covertype (ha; %)	Seral Stage Summary (ha; %)	
							Establish-ment (1)	Young Forest (2)	Mature Forest (3)	Multi-aged (4)				
Salt Marsh	XXSM	Softwood				Early	0	0	0	0	0	5; 19.4	EARLY	20; 82.3
						Mid	0	0	1	0	1			
						Late	0	0	3	0	3			
						Uncl	0	0	0	0	0			
		Mixedwood				Early	5	0	4	7	16	17; 68.7	MID	1; 5.2
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	0	0	0	0	0			
		Hardwood				Early	1	0	1	1	3	3; 11.9	LATE	3; 12.6
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	0	0	0	0	0			
		Unclassified				Early	0	0	0	0	0	0; 0.0	UNCL	0; 0.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	0	0	0	0	0			
Total					**81***	**# ha**	**6**	**0**	**9**	**8**	**24**			
						%	**26.9%**	**1.7%**	**37.8%**	**33.6%**	**100.0%**			

Left side of table refers to "potential" forest, interpreted from the Ecological Land Classification. Right side refers to "current" forest condition, summarized from inventory in the Forest Model. All multi-aged stands can be considered mature and added to mature totals. *Total area of element.

Appendix 10: Table 2: Composition of Forest Communities (in St. Georges Bay Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Tolerant Hardwood Hills Matrix	IFHO WCKK WFHO WFKK WMDM WMDS WMHO WMKK	FREQ GAP GAP GAP GAP GAP FREQ GAP NONE	bS sM yB Be sM yB Be sM yB Be sM yB Be sM yB Be bS wP sM yB Be None	S	SwSDom	8,446	24.3%	E	**Well-drained** Early - tA, ltA, rM, wB, bF Mid - rM, yB, sM, wA Late - sM, yB, wA, Be **Moist** Early - wB, rM, tA, ltA, bF Mid - bF, rS, yB, rM Late - rS, eH, yB, (wP) **Moist-Wet** edaphic bs, tL, rM
				S	SrSbSDom	4,768	13.7%	L	
				S	SbFDom	3,971	11.4%	E	
				S	SSpbFDom	1,305	3.8%	M	
				S	SMHePiSp	47	0.1%	L	
				S	SPiDom	46	0.1%	L	
				M	MIHwSH	6,095	17.5%	E/M	
				M	MIHwHS	4,226	12.1%	E/M	
				M	MTHw	508	1.5%	L	
				H	HIHw	3,900	11.2%	M	
				H	HTHw	840	2.4%	L	
				H	HITHw	643	1.9%	M	
Total						**34,796**	**100.0%**		

*Forest Community Codes:			
	SrSbSDom-Red Black Spruce Dominant SwSDom-White Spruce Dominant SspbFDom-Spruce Fir Dominant SbFDom-Balsam Fir Dominant	SpiDom-Pine Dominant SMHePiSp-Mixed Spruce Pine Hemlock MIHwSH-Intolerant Hardwood Mixedwood S MIHwHS-Intolerant Hardwood Mixedwood H	MTHw-Tolerant Hardwood Mixedwood HIHw-Intolerant Hardwood HTHw-Tolerant Hardwood HITHw-Intolerant Tolerant Hardwood

Appendix 10: Table 2: Composition of Forest Communities (in St. Georges Bay Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Spruce Pine Hummocks	ICHO IFHO IFKK IFSM IMHO IMSM PFHO WCHO WCRD WFHO WMHO WMKK XXMS XXWA	FREQ FREQ GAP GAP FREQ FREQ FREQ FREQ FREQ GAP FREQ GAP NONE NONE	bS wP bS bS wP aE sM wA bS wP bS bS bS wP bS wP sM yB Be bS wP sM yB Be salt marsh NONE	S	SrSbSDom	3,867	32.0%	L	**Well-drained** Early - wB, rM, tA, ltA, bF Mid - bF, rS, yB, rM Late - rS, eH, yB, (wP) **Moist** edaphic bs, tL, rM, (bF) **Wet** wetlands of treeless bogs dominated by shrubs and sphagnum mosses
				S	SwSDom	1,822	15.1%	E	
				S	SbFDom	459	3.8%	E	
				S	SSpbFDom	439	3.6%	M	
				S	SMHePiSp	24	0.2%	L	
				S	SPiDom	13	0.1%	L	
				M	MIHwSH	2,216	18.3%	E/M	
				M	MIHwHS	1,544	12.8%	E/M	
				M	MTHw	147	1.2%	L	
				H	HIHw	1,382	11.4%	M	
				H	HITHw	99	0.8%	M	
				H	HTHw	82	0.8%	L	
Total						**12,092**	**100.0%**		

*Forest Community Codes:			
	SrSbSDom-Red Black Spruce Dominant SwSDom-White Spruce Dominant SspbFDom-Spruce Fir Dominant SbFDom-Balsam Fir Dominant	SpiDom-Pine Dominant SMHePiSp-Mixed Spruce Pine Hemlock MIHwSH-Intolerant Hardwood Mixedwood S MIHwHS-Intolerant Hardwood Mixedwood H	MTHw-Tolerant Hardwood Mixedwood HIHw-Intolerant Hardwood HTHw-Tolerant Hardwood HITHw-Intolerant Tolerant Hardwood

Appendix 10: Table 2: Composition of Forest Communities (in St. Georges Bay Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Spruce Fir Hills and Hummocks	IFKK IFSM XXWA	GAP GAP NONE	bS wP aE sM wA NONE	S	SrSbSDom	1,401	30.4%	L	**Moist** Early - bS, tL, rM, tA, ltA, wB, rM Mid - bS, wP, rM Late - bS, wP
				S	SwSDom	970	21.0%	E	
				S	SSpbFDom	272	5.9%	M	
				S	SbFDom	221	4.8%	E	
				S	SMHePiSp	16	0.4%	L	
				S	SPiDom	2	0.0%	L	
				M	MIHwSH	966	20.9%	E/M	
				M	MIHwHS	383	8.3%	E/M	
				M	MTHw	45	1.0%	L	
				H	HIHw	268	5.8%	M	
				H	HTHw	64	1.4%	L	
				H	HITHw	7	0.1%	M	
Total						**4,615**	**100.0%**		

*Forest Community Codes:			
	SrSbSDom-Red Black Spruce Dominant SwSDom-White Spruce Dominant SspbFDom-Spruce Fir Dominant SbFDom-Balsam Fir Dominant	SpiDom-Pine Dominant SMHePiSp-Mixed Spruce Pine Hemlock MIHwSH-Intolerant Hardwood Mixedwood S MIHwHS-Intolerant Hardwood Mixedwood H	MTHw-Tolerant Hardwood Mixedwood HIHw-Intolerant Hardwood HTHw-Tolerant Hardwood HITHw-Intolerant Tolerant Hardwood

Appendix 10: Table 2: Composition of Forest Communities (in St. Georges Bay Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Valley Corridor	ICHO IFHO IFKK IFSM WCHO WCKK WCSM WFHO WFKK WFSM WMHO WMKK XXMS XXWA	FREQ FREQ GAP GAP FREQ GAP INFREQ GAP GAP GAP FREQ GAP NONE NONE	bS wP bS bS wP aE sM wA bS wP sM yB Be aE sM wA sM yB Be sM yB Be aE sM wA bS wP sM yB Be salt marsh NONE	S	SwSDom	437	22.5%	E	Multiple
				S	SrSbSDom	204	10.5%	L	
				S	SbFDom	68	3.5%	E	
				S	SSpbFDom	40	2.0%	M	
				S	SMHePiSp	7	0.3%	L	
				S	SPiDom	5	0.3%	L	
				M	MIHwSH	376	19.4%	E/M	
				M	MIHwHS	317	16.4%	E/M	
				M	MTHw	60	3.1%	L	
				H	HIHw	306	15.8%	M	
				H	HTHw	73	3.8%	L	
				H	HITHw	47	2.4%	M	
Total						**1,939**	**100.0%**		

*Forest Community Codes:			
	SrSbSDom-Red Black Spruce Dominant SwSDom-White Spruce Dominant SspbFDom-Spruce Fir Dominant SbFDom-Balsam Fir Dominant	SpiDom-Pine Dominant SMHePiSp-Mixed Spruce Pine Hemlock MIHwSH-Intolerant Hardwood Mixedwood S MIHwHS-Intolerant Hardwood Mixedwood H	MTHw-Tolerant Hardwood Mixedwood HIHw-Intolerant Hardwood HTHw-Tolerant Hardwood HITHw-Intolerant Tolerant Hardwood

Appendix 10: Table 2: Composition of Forest Communities (in St. Georges Bay Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Floodplain	IFSM WCSM WFKK WFSM XXWA	GAP INFREQ GAP GAP NONE	aE sM wA aE sM wA sM yB Be aE sM wA NONE	S	SwSDom	468	26.6%	E	**Well-drained** Early - rM, bP, wS Mid - wA, rM, sM, rO, bP Late - aE, sM, wA **Moist** edaphic bS, tL, rM, (bF) and scattered wetlands
				S	SrSbSDom	249	14.2%	L	
				S	SbFDom	168	9.6%	E	
				S	SSpbFDom	55	3.1%	M	
				S	SMHePiSp	5	0.3%	L	
				S	SPiDom	1	0.1%	L	
				M	MIHwSH	369	21.0%	E/M	
				M	MIHwHS	196	11.2%	E/M	
				M	MTHw	38	2.1%	L	
				H	HIHw	190	10.8%	M	
				H	HTHw	12	0.7%	L	
				H	HITHw	6	0.3%	M	
Total						**1,757**	**100.0%**		

*Forest Community Codes:			
	SrSbSDom-Red Black Spruce Dominant	SpiDom-Pine Dominant	MTHw-Tolerant Hardwood Mixedwood
	SwSDom-White Spruce Dominant	SMHePiSp-Mixed Spruce Pine Hemlock	HIHw-Intolerant Hardwood
	SspbFDom-Spruce Fir Dominant	MIHwSH-Intolerant Hardwood Mixedwood S	HTHw-Tolerant Hardwood
	SbFDom-Balsam Fir Dominant	MIHwHS-Intolerant Hardwood Mixedwood H	HITHw-Intolerant Tolerant Hardwood

Appendix 10: Table 2: Composition of Forest Communities (in St. Georges Bay Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Coastal Beach	XXCB	NONE NONE	coastal beach NONE	S	SwSDom	54	37.1%	E	
				S	SrSbSDom	28	19.3%	L	
				S	SSpbFDom	21	14.5%	M	
				S	SPiDom	2	1.0%	L	
				M	MIHwSH	23	15.5%	E/M	
				M	MIHwHS	11	7.7%	E/M	
				H	HIHw	7	4.9%	M	
Total						**147**	**100.0%**		

*Forest Community Codes:	SrSbSDom-Red Black Spruce Dominant SwSDom-White Spruce Dominant SspbFDom-Spruce Fir Dominant SbFDom-Balsam Fir Dominant	SpiDom-Pine Dominant SMHePiSp-Mixed Spruce Pine Hemlock MIHwSH-Intolerant Hardwood Mixedwood S MIHwHS-Intolerant Hardwood Mixedwood H	MTHw-Tolerant Hardwood Mixedwood HIHw-Intolerant Hardwood HTHw-Tolerant Hardwood HITHw-Intolerant Tolerant Hardwood

Appendix 10: Table 2: Composition of Forest Communities (in St. Georges Bay Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Wetlands	WTLD XXWA	NONE NONE	NONE	S	SrSbSDom	11	11.3%	L	N/A
				S	SbFDom	11	11.2%	E	
				S	SwSDom	9	9.0%	E	
				M	MIHwSH	28	29.3%	E/M	
				M	MIHwHS	15	15.7%	E/M	
				H	HIHw	12	12.2%	M	
				S	SrSbSDom	11	11.3%	L	
Total						**97**	**100.0%**		
Salt Marsh	XXMS XXWA	NONE NONE	NONE	S	SrSbSDom	4	18.0%	L	
				M	MIHwHS	11	45.7%	E/M	
				M	MIHwSH	6	24.4%	E/M	
				H	HIHw	3	12.0%	M	
Total						**23**	**100.0%**		

*Forest Community Codes:			
	SrSbSDom-Red Black Spruce Dominant SwSDom-White Spruce Dominant SspbFDom-Spruce Fir Dominant SbFDom-Balsam Fir Dominant	SpiDom-Pine Dominant SMHePiSp-Mixed Spruce Pine Hemlock MIHwSH-Intolerant Hardwood Mixedwood S MIHwHS-Intolerant Hardwood Mixedwood H	MTHw-Tolerant Hardwood Mixedwood HIHw-Intolerant Hardwood HTHw-Tolerant Hardwood HITHw-Intolerant Tolerant Hardwood

Appendix 10:
Table 3: Summary of "Potential Climax" Forest Abundance
(Based on ELC Interpretations)

Climax Type	Ecodistrict		Ecoregion	
	Hectares	Percent	Hectares	Percent
sM yB Be	43,634	48.9%	205,110	24.4%
bS wP	17,714	19.8%	234,959	28.0%
bS	16,726	18.7%	98,073	11.7%
rS eH sM yB Be	3,744	4.2%	3,789	0.0%
aE sM wA	3,702	4.1%	8,937	1.1%
Total	**85,520**	**95.7%***	**550,868**	**65.2%****

*Total does not add up to 100% because wetlands not added.
**Total does not add up to 100% because not all climax vegetation types in region are found in this ecodistrict.
Source: Crown Lands Forest Model Landbase Classification.

Appendix 11: Ecological Emphasis Classes and Index Values

The classification includes all upland conditions, both forested and non-forested, under all types of administration and land use practices. It does not include water or other non-terrestrial conditions.

Ecological Emphasis Class	Conservation Factor	Description
Reserve	**1**	• Reserved lands which meet biodiversity conservation goals through preservation of natural conditions and processes. Resource management activities are not usually permitted except where required to perpetuate desired natural conditions. This class is assigned based on the types of laws and policies governing the management (for example: Wilderness, Parks, Conservation Easement, Old Forest Policy)
Extensive	**0.75**	• Lands managed for multiple values using ecosystem-based techniques that conserve biodiversity, and natural ecosystem conditions and processes. • Forestry practices employ ecosystem-based prescriptions which consider natural disturbance regimes, successional trends, structure, and composition. Natural regeneration is favoured to provide the next forest. Practices may include protection from fire and insects. • Management complies with the Forest Code of Practice and excludes the use of herbicides, exotic tree species, off-site native species, genetically modified organisms, and stand conversion.
Intensive	**0.25**	• Lands managed intensively to optimize resource production from sites maintained in a native state (e.g. forested). Despite intensive practices these lands are an important component of landscape structure and composition. • Management may eliminate or reduce the duration of some development processes, particularly mature old forest stages, and may result in non-natural succession. Practices may produce unnatural conditions such as exotic species, old field spruce, and monoculture plantations, or reduce structure and composition below ecologically desirable levels. Forests are protected from fire, insects, and competing vegetation. • Management adheres to environmental regulations and policies such as the Wildlife Habitat and Watercourse Protection Regulations and Forest Code of Practice.
Converted	**0**	• Land converted to an unnatural state for human use, or areas where practices have significantly degraded site productivity (e.g. agriculture, urban development roads, Christmas trees, seed orchards, forest soil compaction).

Appendix 12a: Ecological Emphasis Index Worksheet – Elements

Landscape Element	Total Land Area (ha)	Ecological Emphasis Classes					Ecological Emphasis Index	
		Reserve Area (ha)	Extensive Forest Management Area (ha)	Intensive Forest Management Area (ha)	Conversion to Non-Forest Area (ha)	Unclassified Land Use Area (ha)	Effective Area Range (ha)	EEC Index Range
Tolerant Hardwood Hills	46,576	396	21,352	2,756	11,998	10,073	19,618 to 24,654	42 to 53
Spruce Pine Hummocks	17,336	399	9,306	689	4,410	2,532	8,184 to 9,450	47 to 55
Spruce Fir Hills and Hummocks	5,878	12	2,732	375	1,581	1,177	2,450 to 3,038	42 to 52
Valley Corridors	4,885	17	2,251	78	2,180	360	1,814 to 1,994	37 to 41
Floodplain	2,905	4	1,381	157	892	471	1,197 to 1,432	41 to 49
Coastal Beach	468	289	151	0	25	4	403 to 405	86 to 87
Wetlands	214	0	182	1	5	27	143 to 157	67 to 73
Salt Marsh	77	1	65	0	11	0	50	65
Total	**78,339**	**1,118**	**37,420**	**4,055**	**21,100**	**14,645**	**33,858 to 41,180**	**43 to 53**

These classes have been given a weighting percentage representing their ecological emphasis level: Reserve (100), Extensive (75), Intensive (25), and Converted (0). These percentages are applied to the area of land in each class to determine the "effective area" which is divided by "total area" to calculate the index.

The Unclassified land is too young to determine if it is being managed extensively or intensively. Therefore, an EEI range is reported based on it being all one or the other.

Water was not included as an element type. Areas were rounded to the nearest hectare.

EEI values are benchmarks that will be monitored over time.

Appendix 12b: Ecological Emphasis Index Worksheet – Ecosections

Ecosection	Total Land Area (ha)	Ecological Emphasis Classes					Ecological Emphasis Index	
		Reserve Area (ha)	Extensive Forest Management Area (ha)	Intensive Forest Management Area (ha)	Conversion to Non-Forest Area (ha)	Unclassified Land Use Area (ha)	Effective Area Range (ha)	EEC Index Range
ICHO	1,339	4	648	28	501	159	537 to 616	40 to 46
IFHO	8,728	82	5,387	461	1,337	1,460	4,603 to 5,333	53 to 61
IFKK	6,170	12	2,938	385	1,634	1,201	2,612 to 3,212	42 to 52
IFSM	4,717	6	2,009	157	2,005	540	1,686 to 1,956	36 to 41
IMHO	410	0	209	8	110	83	179 to 221	44 to 54
IMSM	159	0	104	2	42	11	81 to 87	51 to 55
PFHO	57	0	41	0	16	0	31	54
WCHO	3,213	7	1,424	152	1,176	454	1,227 to 1,454	35 to 45
WCKK	2,454	10	832	51	1,140	420	752 to 962	31 to 39
WCRD	114	27	62	3	7	15	79 to 86	69 to 75
WCSM	153	0	65	7	37	44	61 to 83	40 to 54
WFHO	7,265	174	3,664	243	1,847	1,337	3,317 to 3,985	46 to 55
WFKK	32,943	117	15,040	2,315	7,654	7,817	13,930 to 17,839	42 to 54
WFSM	1,195	2	487	38	538	131	409 to 475	34 to 40
WMDM	191	1	147	5	13	25	119 to 132	62 to 69
WMDS	220	5	120	11	71	12	102 to 108	46 to 49
WMHO	4,272	282	2,010	50	1,520	415	1,906 to 2,113	45 to 49
WMKK	3,932	98	1,775	139	1,415	504	1,590 to 1,842	40 to 47
WTLD	213	0	181	1	5	26	143 to 156	67 to 73
Total	**77,744**	**828**	**37,143**	**4,057**	**21,066**	**14,655**	**33,362 to 40,690**	**43 to 52**

For an explanation of calculations and other information to help better understand this table, please refer to the bottom of Appendix 12a.

Appendix 13:

Glossary B: Terms in Parts 1, 2, and 3

Aspect	The direction of a downhill slope expressed in degrees or as a compass point.
Atlantic Coastal Plain Flora (ACPF)	A group of 90 species of taxonomically unrelated wetland plants that inhabit lake and river shores, bogs, fens, and estuaries and which are found primarily in southwestern Nova Scotia. The distribution of this group of plants extends down the eastern coast of the USA with isolated populations in Nova Scotia and along the Great Lakes.
Biodiversity	The diversity of plants, animals, and other living organisms, in all their forms and level of organization, including genes, species, ecosystems, and the evolutionary and functional process that link them.
Canopy	The uppermost continuous layer of branches and foliage in a stand of trees.
Climax forest community	A relatively stable and self-perpetuating forest community condition that maintains itself (more or less) until stand-level disturbance causes a return to an earlier successional stage. The final stage of natural succession for its environment.
Climax vegetation	A forest or non-forest community that represents the final stage of natural succession for its environment.
Coarse filter approach	A habitat-based approach to conserving biodiversity by maintaining a natural diversity of structures within stands, and representation of ecosystems across landscapes. The intent is to meet the habitat requirements of most native species over time. Usually combined with a fine filter approach to conserve specific rare species and ecosystems.
Coarse Woody Debris (CWD)	Dead tree stems greater than 7.5 centimetres in diameter and laying horizontally at 45 degrees or less. Provides habitat for many species and is a source of nutrients for soil development.
Commercial thinning	Silviculture treatment that “thins” out an overstocked stand by removing trees that are large enough to be sold as products, such as poles or fence posts. This treatment is carried out to improve the health and growth rate of the remaining crop trees.

Composition	The proportion of biological components within a specified unit such as a stand or landscape: **Stand or Species Composition.** The proportion of each plant species in a community or stand. May be expressed as a percentage of the total number, basal area, or volume of all species in that community. **Landscape Composition.** The proportion of each community type within a landscape. Community type may be defined by vegetation type, covertype, seral stage, or development class (age).
Connectivity	The way a landscape enables or impedes movement of resources, such as water and animals.
Converted	Lands removed from a natural state (e.g. forest) and changed to other uses (e.g. agriculture, urban, settlement, road).
Corridor	Corridors are natural linear communities or elements, such as river valleys, that link parts of the ecodistrict. They are a fundamental feature of the "matrix, patch, corridor" concept of landscape structure.
Crown land and Provincial Crown land	Used in the Ecological Landscape Analysis to include all land under the administration and control of the Minister of Natural Resources under the Forests Act, Section 3; as well as the lands under the administration and control of the Minister of Environment under the Wilderness Areas Protection Act. Also includes Federal Parks in the accounting of protected area representation.
Covertype	Refers to the relative percentage of softwood versus hardwood species in the overstory of a stand. In this guide, covertype classes are: **Softwood:** softwood species compose 75% or more of overstory **Hardwood:** hardwood species compose 75% or more of overstory **Mixedwood:** softwood species composition is between 25% and 75%
Development class	The description of the structure of forests as they age and grow (e.g. establishment forest, young forest, mature forest, multi-aged / old forest).
Disturbance	An event, either natural or human-induced, that causes a change in the existing condition of an ecological system.
Ecodistrict	The third of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecoregions. Characterized by distinctive assemblages of relief, geology, landform, and vegetation. Used to define the landscape unit for these Ecological Landscape Analysis reports.

Ecological land classification	A classification of lands from an ecological perspective based on factors such as climate, physiography, and site conditions. The Ecological Land Classification for Nova Scotia Volume 1 delineates ecosystems at five hierarchical scales: ecozone, ecoregion, ecodistrict, ecosection, and ecosite.
Ecological integrity	The quality of a natural unmanaged or managed ecosystem in which the natural ecological processes are sustained, with genetic, species, and ecosystem diversity assured for the future.
Ecoregion	The second level of the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecozone. Used to characterize distinctive regional climate as expressed by vegetation. There are nine ecoregions identified in Nova Scotia.
Ecosection	The fourth of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecodistricts. An ecological land unit with a repeating pattern of landform, soils, and vegetation throughout an ecodistrict.
Ecosite	The fifth of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecosections. Characterized by conditions of soil moisture and nutrient regimes. Although not mapped, the Acadian and Maritime Boreal ecosites of the province are fully described in the Forest Ecosystem Classification for Nova Scotia (2010).
Ecosystem	A functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size – a log, pond, field, forest, or the Earth's biosphere – but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation, such as a forest ecosystem, old-growth ecosystem, or range ecosystem. Can also refer to units mapped in the DNR Ecological Land Classification system.
Ecozone	The first of five levels in the Ecological Land Classification for Nova Scotia Volume 1. Ecozones are continental ecosystems characterized by the interactions of macroclimate, soils, geographic, and physiographic features. The entire province is contained within the Acadian ecozone, one of 15 terrestrial ecozones in Canada.
Edge effect	Habitat conditions (such as degree of humidity and exposure to light or wind) created at or near the more-or-less well-defined boundary between ecosystems, as, for example, between open areas and adjacent forest.

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.
Extensive land use	Lands managed for multiple values using ecosystem-based techniques that conserve biodiversity and natural ecosystem conditions and processes.
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).
Fine filter approach	An approach to conserving biodiversity that is directed toward individual species and critical ecosystems that are typically rare or threatened. This approach is usually combined with the coarse filter approach to conserving natural ranges of habitat.
Forest management	The practical application of scientific, economic, and social principles to the administration and working of a forest for specified objectives. Particularly, that branch of forestry concerned with the overall administrative, economic, legal, and social aspects and with the essentially scientific and technical aspects, especially silviculture, protection, and forest regulation.
Frequent stand initiating	Disturbances usually occur more frequently than the average lifespan of the dominant species and are of sufficient intensity to destroy most of the existing trees, promoting a new forest within relatively short periods of time.

Gap replacement	An absence of stand-initiating disturbances supports the development of a dominant overstory that is sustained through dynamic processes of canopy gap formation, understory development, and overstory recruitment. Gap formation ranges from individual tree mortality to periodic gap formation events that are rarely of a stand-initiating intensity.
Habitat	The place where an organism lives and/or the conditions of that environment including the soil, vegetation, water, and food.
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.
Intensive land use	Lands managed intensively to optimize resource production from sites maintained in a forested state.
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.
Long range management frameworks	A strategic, integrated resource plan at the subregional level. It is based on the principles of enhanced public involvement, consideration of all resource uses and values, consensus-based decision making, and resource sustainability.

Matrix	A widespread vegetation forest community which dominates the landscape and forms the background in which other smaller scale communities (patches) occur. The most connected or continuous vegetation type within the landscape, typically the dominant element. (Matrix is a fundamental feature of the "matrix, patch, corridor" concept of landscape structure).
Mature forest	A development class within the sequence of: 1) forest establishment; 2) young forest; 3) mature forest; and 4) multi-aged and old growth. Mature forests include multi-aged and old growth. Forests are typically taller than 11 metres, have an upper canopy fully differentiated into dominance classes, and regularly produce seed crops. Mature forests may develop over long periods, transitioning from early competitive stages where canopy gaps from tree mortality soon close, to later stages where openings persist and understories develop to produce multi-aged and old growth.
Memorandum of understanding (MOU)	An agreement between ministers defining the roles and responsibilities of each ministry in relation to the other or others with respect to an issue over which the ministers have concurrent jurisdiction.
Mixed stand	A stand composed of two or more tree species.
Multiple use	A system of resource use where the resources in a given land unit serve more than one user.
Natural disturbance	A natural force that causes significant change in forest stand structure and/or composition such as fire, wind, flood, insect damage, or disease.

Natural disturbance regimes	The patterns (frequency, intensity, and extent) of fire, insects, wind, landslides, and other natural processes in an area. Natural disturbances inherently influence the arrangement of forested ecosystems and their biodiversity on a given landscape. Three disturbance regimes recognized in Nova Scotia are: **Frequent:** Disturbances which result in the rapid mortality of an existing stand and the establishment of a new stand of relatively even age. The time interval between stand-initiating events typically occurs more frequently than the longevity of the climax species that would occupy the site – therefore, evidence of gap dynamics and understory recruitment is usually absent. This regime results in the establishment and perpetuation of early to mid-successional vegetation types. **Infrequent:** Stand-initiating disturbances which result in the rapid mortality of an existing stand and the establishment of a new stand of relatively even-age, but the time interval between disturbance events is normally longer than the average longevity of the dominant species – allowing gap dynamics and understory recruitment to evolve and become evident (eventually creating uneven-aged stands). This regime generally leads to the establishment and/or perpetuation of mid to late successional vegetation types. **Gap replacement:** Stand-initiating disturbances are rare. Instead, disturbances are characterized by gap and small patch mortality, followed by understory recruitment, resulting in stands with multiple age classes. This regime generally leads to the establishment and/or perpetuation of late successional vegetation types.
Old growth	Climax forests in the late stage of natural succession, the shifting mosaic phase, marked by mature canopy processes of gap formation and recruitment from a developed understory. Typical characteristics include a multi-layered canopy of climax species containing large old trees, decadent wolf trees, and abundant snags and coarse woody debris. In Nova Scotia, stands older than 125 years are classed as old growth.
Patch	A discrete community or element nested within a surrounding landscape, which is often a matrix forest. (Patch is a fundamental feature of the “matrix, patch, corridor” concept of landscape structure.)
Pre-commercial thinning	A silviculture treatment to reduce the number of trees in young stands before the stems are large enough to be removed as a forest product. Provides increased growing space and species selection opportunities to improve future crop tree growth.

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.
Road deactivation	Measures taken to stabilize roads and logging trails during periods of inactivity, including the control of drainage, the removal of sidecast where necessary, and the re-establishment of vegetation for permanent deactivation.
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 which 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.
Threatened species	A species that is likely to become endangered if the factors affecting its vulnerability are not reversed. A species declared as threatened under the federal or Nova Scotia species at risk legislation (NS Endangered Species Act or federal SARA).
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.
Vernal pool	A seasonal body of standing water that typically forms in the spring from melting snow and other runoff, dries out in the hotter months of summer, and often refills in the autumn.

Vulnerable species	A species of special concern due to characteristics that make it particularly sensitive to human activities or natural activities or natural events. May also be referred to as “species of special concern.” A species declared vulnerable 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).

Literature Referenced

Bruce, J. and B. Stewart. 2005. Development of a "road index" for landscape level assessment of linear transportation features using density, distance, and class measures. Unpublished report.

Diaz, N. and D. Apostol. 1992. Forest landscape analysis and design: a process for developing and implementing land management objectives for landscape patterns. R6 ECO-TP-043-92. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region.

Duke, T. and L. Benjamin. 2005. Forest / wildlife habitat and management guide, 560 – Chignecto Ridges. Department of Natural Resources, Kentville. Internal report. 15pp.

Dunster, J. and K., Dunster. 1996. Dictionary of natural resource management. UBC Press. 363 pp.

Fenow, B.E. 1912. Forest Conditions of Nova Scotia. 93 pp.

Forman, R.T.T. 2004. Road ecology's promise: what's around the bend? Environment 46(4):8-21.

Forman, R.T.T. and R.D. Deblinger. 2000. The ecological road-effect zone of a Massachusetts (USA) suburban highway. Conservation Biology 14: 36-46.

Forman, R.T.T. 1999. Spatial models as an emerging foundation of road system ecology, and a handle for transportation planning and policy. In Proceeding of the Third International Conference on Wildlife Ecology and Transportation, edited by G.L.Evink, P.Garrett, and D.Zeigler, 118-123. Tallahassee, Florida: Florida DOT.

Lindenmayer, D. B. and J. F. Franklin. 2002. Conserving forest biodiversity: a comprehensive multi-scaled approach. Island Press. ISBN 1-55963-935-0. 351 pp.

Methven, I. and M. Kendrick. 1995. A Disturbance History Analysis of the Fundy Model Forest Area. 16pp.

Mailman, G. E. 1975. Tobeatic Resource Management Area Land Inventory. Nova Scotia Department of Natural Resources.

Neily, P. and E. Quigley. 2005. Natural disturbance ecology in the forests of Nova Scotia. Ecosystem Management Group, Department of Natural Resources, Truro. Unpublished report.

Neily, P., E. Quigley, L. Benjamin, B. Stewart, and T. Duke. 2003. Ecological land classification for Nova Scotia. Vol. 1 - mapping Nova Scotia's terrestrial ecosystems. Nova Scotia Dept. of Natural Resources, Forestry Division, Truro. 83 pp.

Nova Scotia Department of Natural Resources. 2006. Guidelines for the development of long range management frameworks. Nova Scotia Department of Natural Resources, Regional Services, Halifax. 33 pp.

Nova Scotia Department of Natural Resources. 2002. Wildlife Habitat and Watercourses Protection Regulations. Section 40 of the Forests Act R.S.N.S. 1989, c. 179 O.I.C. 2001-528 (November 15, 2001, effective January 14, 2002), N.S. Reg. 138/2001 as amended by O.I.C. 2002-609 (December 20, 2002), N.S. Reg. 166/2002
http://www.gov.ns.ca/natr/wildlife/habitats/protection/

Reed, R.A., J.Johnson-Barnard, and W.L. Baker. 1996. Contribution of roads to forest fragmentation in the Rocky Mountains. Conservation Biology 10:1098-1106.

Seymour, R. S. and M. L. Hunter, Jr. 1999. Principles of Forest Ecology. Chapter 2. In: M.L. Hunter Jr. Ed. Maintaining Biodiversity in Forest Ecosystems. 698 pp.

Spellerberg, I.F. 1998. Ecological effects of roads and traffic: a literature review. Global Ecology & Biogeography Letters 7, 317-333.

Stewart, B. and P. Neily. 2008. A procedural guide for ecological landscape analysis. Department of Natural Resources, Truro. Report for 2008-2.

Strang, R. M. 1972. Ecology and land use of barrens of Western Nova Scotia. Canadian Journal of Forest Resources. 2(3): 276-290.

USDA Forest Service.1999. Roads analysis: informing decisions about managing the national forest transportation system. Misc. Rep FS-643. Washington, D.C.: U.S. Department of Agriculture, Forest Service. 222 p.