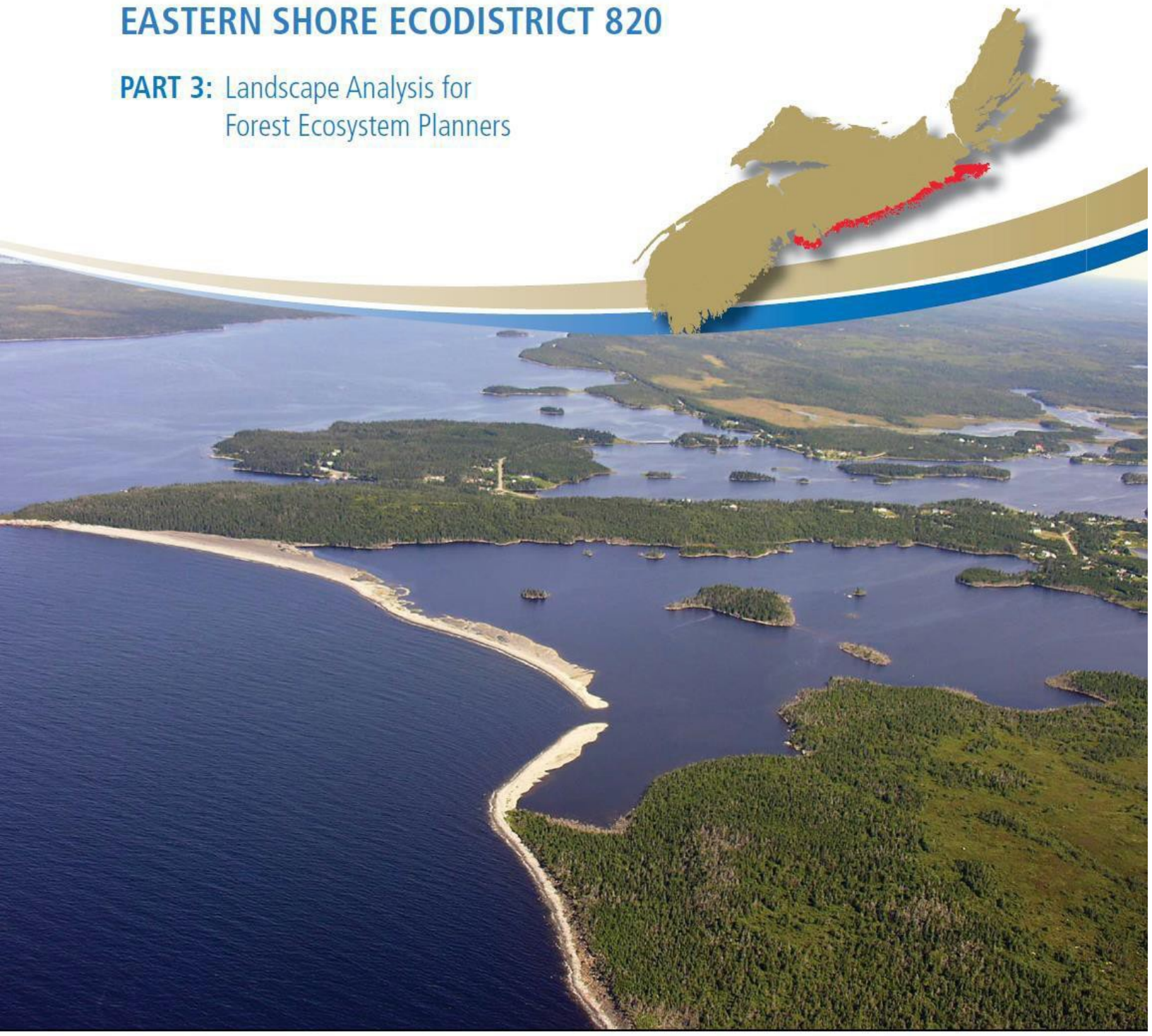
Department of Natural Resources

ECOLOGICAL LANDSCAPE ANALYSIS EASTERN SHORE ECODISTRICT 820

PART 3: Landscape Analysis for Forest Ecosystem Planners



ELA 2015-820

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 820: Eastern Shore

Prepared by the Nova Scotia Department of Natural Resources
Authors: Central Region DNR staff

ISBN 978-1-55457-605-0

This report, one of 38 for the province, provides descriptions, maps, analysis, photos and resources of the Eastern Shore Ecodistrict.

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

Information sources and statistics (benchmark dates) include:

- Forest Inventory (1995) – stand volume, species composition
- Crown Lands Forest Model landbase classification (2006) – provides forest inventory update for harvesting and silviculture from satellite photography (2005), silviculture treatment records (2006), and forest age increment (2006)
- Roads and Utility network – Service Nova Scotia and Municipal Relations (2006)
- Significant Habitat and Species Database (2007)
- Atlantic Canada Data Conservation Centre (2013)

Conventions

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

REPORT FOR ELA 2015-820

Table of Contents – Part 3

Tables

Appendices

Theme Maps Available on Website

Map 1	Land Capability
Map 2	Elements and Flows
Map 3	Ecological Emphasis Classes
Map 4	Natural Disturbances
Map 5	Road Index
Map 6	Special Occurrences
Map 7	Rare Ecosections
Map 8	IRM Classes
Map 9	Development Classes
Map 10	Seral Stages

Part 3: Landscape Analysis of Eastern Shore – *For Forest Ecosystem Planners*

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:

Understanding the Landscape as an Ecological System

- Elements Within Landscapes
- Flow-Element Interactions
- Landscape Connectivity

Landscape Indicators

- Forest Composition Indicators
- Land Use Indicators

Fine Scale Features

- Priority Species and Other Special Occurrences
- Rare Ecosections
- Ecological Representivity

ELA Summary

- Element Interpretation
- Ecosystem Issues and Opportunities

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 10 distinctive elements in the Eastern Shore Ecodistrict – one matrix, a local co-matrix, seven 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).

Coastal Spruce is the widely dispersed dominant matrix element, found on 26% of the ecodistrict, occurring on hummocks, drumlins, flats, ridges, and low hills. Soils are well to imperfectly drained, fine to medium-textured glacial tills supporting a typical coastal forest of black spruce, white spruce, and balsam fir. A few small areas of yellow birch, white birch, and red maple also occur.

Coastal Barrens is a locally dominant co-matrix element, covering 35% of the ecodistrict, associated primarily with the Chebucto and Chedabucto peninsulas. Soils are impoverished, derived from glacial till peppered with large granite boulders. Vegetation includes stunted spruce and woody shrubs. Often soils are shallow to bedrock and reindeer lichens form extensive mats.

Three large coastal elements, **Coastal Mixedwood Hills**, **Coastal Spruce Ridges**, and **Coastal Mixedwood Hills and Drumlins**, represent 34% of the ecodistrict. The four other patch elements, in order of size, are **Wetlands, Coastal Spruce Flats, Coastal Beach,** and **Salt Marsh**.

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

The main corridor systems follow the main river valleys. These systems dissect the ecodistrict but also provide linkages to the Eastern Interior, Eastern Granite Uplands, and the St. Margarets Bay ecodistricts. These corridors are usually associated with long narrow salt water inlets from the ocean and provide a valuable linkage to the coastline for many interior species of wildlife. Some of these corridors have been significantly altered by human land use, settlement, transportation and utility systems, agriculture, and forestry.

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: people, deer, anadromous fish, migratory birds, sea birds, and black bear.

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:

River corridors promote connectivity.

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.

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.

Due to the narrowness of the Eastern Shore Ecodistrict, connectivity with inland ecodistricts can be restricted by human activities such as settlement and transportation corridors. The current forest maintains much of its inherent ecological integrity and attributes. However, where human land use, transportation systems, and utility corridors have become the dominant feature on the landscape – for example, Eastern Passage to Head of Chezzetcook – this fragmentation has reduced the connective function of the corridors for some species and may also increase the barrier effect of the corridors for species that must move across them.

Inherent in all ecological planning is the maintenance of connectivity among conservation areas (including wilderness, old growth, provincial parks, and ecological reserves) that are often not

ecologically related. For the Eastern Shore Ecodistrict, maintaining connectivity with the inland conservation areas is more important than maintaining connectivity to those within the ecodistrict. The seasonal use of the coastal zone by species that also inhabit the inland zone is a feature that can be maintained by the dominant forest structure.

Within the Eastern Shore Ecodistrict, offshore islands create an independent ecological entity similar to the mainland but separated by salt water and exposure to more climatic extremes. However, these disjunctive ecosystems provide a seasonal ecological service for some mainland species, mostly birds, and as such should be considered in the planning process. The islands also have a suite of biodiversity issues only associated with their island stature, such as seals.

Connectivity will be sustained by applying the natural disturbance regime guidelines for landscape composition (Table 7) and recognizing natural linkage opportunities.

Connectivity issues and opportunities for Eastern Shore include:

- Mitigating the potentially negative barrier effects of concentrated land use in the Valley Corridors element 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.
- Ensuring that offshore islands are included in connectivity planning.

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

All of the landscape flows are identified with major linkages to adjacent areas or ecodistricts (Map 2). The hydrological system provides the most obvious physical connection among the Eastern Shore, Eastern Granite Uplands, and Eastern Interior ecodistricts. Other significant linkages are the narrow peninsulas that connect the inland ecodistricts to the coastal zone. Extending inland for many kilometres are long narrow inlets and harbours (e.g. Petpeswick Inlet, Jeddore Harbour and Country Harbour) and brackish lakes (e.g. Porters Lake) that provide a route of flow for people, wildlife, and biodiversity.

Depending on the severity of the winter, deer move from the inland locations and into their wintering areas along the Atlantic coast. Black bear also move seasonally among ecodistricts using the summer to forage for berries on the barrens along the coast before retreating inland to hibernate. The coastal islands are also used by many species of inland birds as overwintering areas and/or nesting areas returning later in the summer to their inland locales for feeding. People provide linkages throughout the ecodistrict into adjoining ecodistricts through their many activities of recreation, transportation, fishing, hunting, forest management, utilities development, and settlements.

Future land management activities should recognize the significant linkages to those neighbouring ecodistricts and manage 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 (see 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 Eastern Shore

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Coastal Mixedwood Hills and Drumlins	OF1, OF2, OF4	3.0	CO5	12.0	**CO4, CO6**	73.0
Coastal Mixedwood Hills	OF1, OF2, OF4	3.0	CO4, CO5	10.0	**CO1, CO2, CO6**	68.0
Coastal Spruce	OW1, OW2, CO5, SP1				**CO1, CO2, CO4,** SP4	82.0
Coastal Barrens	**CO1**, CO2, CO4, OW1, OW2, SP1					
Coastal Spruce Flats	CO1, **SP7**, WC1, WC2					
Coastal Spruce Ridges	**CO1**, CO2, CO4					
Salt Marsh	Grasslands of *Spartina spp.*					
Coastal Beach	CO7, Beach grass, Bayberry, Rose spp., White spruce					
Wetlands	WC1, WC2, WC3, WC6, WC7, WD2, WD3, WD6, SP7					

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

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 overall EEI for Eastern Shore is 71 to 74 (Appendices 12a and 12b), which would suggest that overall intensity of land use is currently able to maintain the structure and function to support habitat for all species and for biodiversity conservation. The EEI for the two co-matrix elements, Coastal Barrens and Coastal Spruce, which make up 61% of the ecodistrict, is 68 to 79, indicating an even greater level of ecological intactness.

About 70% of the lands fall within the extensive ecological emphasis class.

The other classes, in order of size, are reserve (16%), converted (6%), and intensive (1%). Unclassified lands account for 7% of the ecodistrict. The area in water is 6%.

Converted lands are those areas that have been altered by human settlement, farming, urban development, and transportation and utility corridors. These converted lands are predominately located around the major river corridors and along the shoreline, villages, and towns. In this ecodistrict, lands that have been cleared to support settlement, the fishery, and farming readily return to forest when abandoned and within one or two rotations will be representative of the natural forest condition.

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.

Currently, Eastern Shore has an overall RI value of 10 (Appendix 7, Table 3). This average falls within the Forest Resource range of 7 to 15 and may be described as moderately low (Appendix 7, Table 2). This low index value is heavily influenced by the significant 40% of the ecodistrict that is in the Remote Road range of 0 to 6, indicating that there are some very large areas that do not have roads, such as on the Canso peninsula and large areas between Port Hilford and Larrys River. Sixty percent of the ecodistrict has road indices in the Forest Resource, Mixed Rural, and Agriculture Suburban categories.

The highest road densities occur around settlements and main transportation systems with most of this near metro Halifax.

Roads can contribute to habitat fragmentation and environmental degradation. Efforts to reduce these impacts could include:

- Conserving the relatively low road densities within the co-matrix elements (RI 7 to 11) through strategic scheduling of new access and decommissioning where possible. Private woodland owners may be able to decommission select roads and share access.
- Accessing systems must be scheduled for regular maintenance or decommissioning, particularly where connectivity or additional reserves are to be established.
- Recreational trails should utilize old abandoned trails or logging roads before additional trails are established.
- Using a central planning system to provide coastal access for resources, recreation, tourism activities, and summer homes to reduce road density. Continuing strip development along the shoreline is fragmenting the ecosystem and impacting wildlife access to the coastal interface.

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 is 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 needs 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 one (extremely) to five (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 2013 in the Eastern Shore Ecodistrict, there are documented occurrences (under the NSESA) of the following number of formally listed species at risk: 10 endangered, two threatened, and two vulnerable. Six other species at risk that are either formally listed through SARA and/or designated by the Committee of the Status of Endangered Wildlife in Canada (COSEWIC) also occur in the ecodistrict. In addition to the species at risk, the national General Status process also identifies 13 orange-status species, 51 yellow-status species and 23 green-status species, seven species with an undetermined rank, one exotic species, and one extirpated species for a total of 94 other species of conservation concern in this ecodistrict.

Designated species at risk found within the Eastern Shore Ecodistrict include Atlantic salmon (fish), wood turtle (reptiles), moose and little brown bat (mammals), monarch (insects), Eastern white cedar (gymnosperms), blue and boreal felt lichen (lichens), and several bird species including shorebirds, aerial insectivores, waterfowl, and others.

Other species of conservation concern known for the Eastern Shore Ecodistrict include many more shorebird, passerine, and seabird species (birds); hoary bat (mammals); oscillated darner and black meadowhawk (insects); ghost antler and coastal bushy-beard lichen (lichens), three sensitive moss species, and many vascular plant species, including limestone scurvy grass, least moonwort, and Greene’s rush.

Old Forest

The Interim Old Forest Policy requires a minimum of 8% of Crown land within each ecodistrict be identified and protected. The stands are selected to provide representation of landscape elements with the best old forest and old forest restoration opportunities. *In 2012, DNR released an updated Old Forest Policy, containing new Integrated Resource Management (IRM) decision-making procedures (see http://novascotia.ca/natr/library/forestry/reports/Old-Forest-Policy-2012.pdf).*

Old growth stands have been identified on 6,906 hectares (Appendix 5) in the Eastern Shore Ecodistrict, or approximately 10% of the Crown lands under the Old Forest Policy.

Birds

As of 2013, there are known occurrences for twelve at risk bird species in the ecodistrict. Eight are listed under the NSESA: red knot, piping plover, rusty blackbird, barn swallow, harlequin duck, roseate tern, and Canada warbler as endangered; and olive-sided flycatcher as threatened. Nationally, piping plover and roseate tern are listed as endangered; olive-sided flycatcher and Canada warbler as threatened; rusty blackbird, peregrine falcon, harlequin duck, and savannah sparrow as special concern; and bank swallow and buff-breasted sandpiper have neither provincial nor federal listing status but have been designated by COSEWIC as threatened and special concern, respectively.

There has been a nationwide decline in aerial insectivores, such as olive-sided flycatcher, barn swallow and bank swallow, presumably due to declines in insect food species. Barn swallow are also threatened by the loss of human-made structures (old barns in particular). Declines in aerial insectivores as well as rusty blackbird and Canada warbler populations are also thought to be attributed, in part, to habitat loss and land use practices, particularly on wintering grounds.

Three shorebird species at risk are known to the ecodistrict as well as many other shorebirds of special concern.

Beaches in the ecodistrict are important to migrating shorebirds that nest and winter elsewhere, but the ecodistrict has supported nesting piping plover and wintering purple sandpiper. Beaches particularly important to piping plover in the ecodistrict are Conrods, Martinique, Lawrencetown, Taylors Head Bay and Stoney.

As ground-nesting birds with precocious young, the shorebird group as a whole experiences low nesting success due to natural predation, extreme weather and nest destruction by humans from all-terrain vehicles, beach walkers, and dogs off-leash on the nesting beaches. The province participates in monitoring and stewardship activities for nesting piping plover wherever they nest in the province.

The coastline and islands of the ecodistrict are of great importance to wintering waterfowl, where inlets provide open water during cold temperatures. Harlequin duck is among the waterfowl species observed to winter in the ecodistrict, particularly in St. Margarets Bay, from Clam Harbour east to Liscomb, and around the Canso peninsula. Colonial-nesting waterfowl and seabirds, such

as common eider and roseate tern, also rely on the islands of the ecodistrict for their most consistent and successful nesting areas in the province. Goose Island and Country Island off the coast of Drum Head are particularly important to roseate tern.

Historically, the peregrine falcon experienced a rapid decline as a result of the pesticide DDT (Dichloro-diphenyl-trichloroethane), which had an influence on the strength of egg-shells during incubation. Since the ban on DDT in the 1970s, peregrine falcon populations have recovered significantly. Shut-in Island in St. Margarets Bay is known to have supported nesting peregrine falcons and a large nesting colony of great cormorants.

Fish

Atlantic salmon have historically used the watersheds of the Eastern Shore Ecodistrict for spawning and rearing, and continue to make some use of the habitat available in these river systems. COSEWIC has assigned designatable units (DU) that refer to the populations of Atlantic salmon that should be assessed independently from one another. The DU that applies to the Atlantic salmon in the Eastern Shore Ecodistrict is called the Southern Uplands population, which is designated by COSEWIC as endangered but not listed under either the provincial or federal legislation.

Barriers to dispersal and acidification of many areas within these watersheds are thought to have drastically reduced the amount of freshwater habitat that may be used by Atlantic salmon for spawning and rearing, although it is low returns from the marine environment that continues to be considered the most important factor in the decline of Atlantic salmon.

Gymnosperms

A single Eastern white cedar tree is known in the Eastern Shore Ecodistrict. It occurs on Country Island off the shores of Drum Head. Most occurrences of the species are located in Western Nova Scotia with an estimated population of 13,000 to 15,000 trees. Threats to species are cutting for land clearing and forestry and poor recruitment of seedlings due to animal browsing.

Insects

Monarch butterflies are designated by COSEWIC and listed under SARA as special concern but have no provincial designation. Adults may occasionally be observed after the breeding season in the Eastern Shore Ecodistrict as they may in most other areas of the province. Areas with high concentrations of milkweed are used by breeding adults and larval development; there are no records of such areas in the ecodistrict.

Lichens

Two lichen species-at-risk are found in the ecodistrict. The Atlantic population of boreal felt lichen is designated by COSEWIC as endangered and listed under the federal SARA and NSESA as the same. Blue felt lichen is designated by COSEWIC as special concern and is listed federally as special concern and provincially as vulnerable.

The distribution of boreal felt lichen in Nova Scotia is largely limited to within tens of kilometres from the Atlantic coast, in high-humidity forested areas adjacent to or within wetlands that have a major balsam fir population.

Blue felt lichen is known from 88 locations in Nova Scotia that represent a considerable portion of the entire range known in North America. In Nova Scotia, blue felt lichen are generally found in mixed forests containing red maple that are in wet depressions or adjacent to streams, rivers, or lakes in coastal areas up to 300 metres in elevation.

For both lichen species at risk known to the ecodistrict, surveys in other potential habitat areas may reveal additional occurrences.

Both of these lichen species are considered cyanolichens, a group that is threatened by atmospheric pollutants and acid precipitation, which changes the chemistry of the bark on the trees on which the lichens grow and which can cause direct mortality or interfere with reproduction. Also, their habitats often overlap with areas otherwise suitable for forest harvesting activities, which can serve as threat to the species either by direct mortality or habitat loss.

Forestry activities on Crown land in areas where boreal felt lichen may occur are subject to special management practices for the species, which requires that surveys for the species are conducted, and if found, an area buffering the occurrence will not be harvested.

Mammals

Moose on the mainland of Nova Scotia have been designated as endangered 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 (e.g. blowdown), disease, or timber harvesting. The habitat requirements of moose are largely dependent on successional forest stages. Early successional hardwood trees and shrubs provide necessary browse vegetation while mature conifer cover is valuable for shelter, thermal cover, and protection in winter and summer. Natural disturbance to the moose habitat on the Crown land of the ecodistrict is only moderately supplemented with human-induced disturbance.

Since 2012, special management practices in support of moose have been made mandatory for forestry activities on Crown land in designated moose concentration areas. These practices aim to conserve thermal refugia, aquatic feeding sites, calving areas, and visible cover. Two portions of the Eastern Shore Ecodistrict fall within a designated moose concentration area: the Chebucto peninsula and the section from approximately Moser River to Canso. Elsewhere in the ecodistrict moose are occasionally reported as the ecodistrict will often serve moose dispersing among more significant concentration areas in the province.

In 2013, the little brown myotis, northern long-eared myotis, and tri-coloured bat were all listed under the NSESA as endangered.

The population of all three bat species, the most common of which in Nova Scotia is little brown myotis, has experienced an alarming decline due to a disease known as white-nose syndrome caused by the fungus *Pseudogymnoascus destructans.* This disease has killed nearly 7 million bats in eastern North America in the past eight years and estimates of a 90% decline in Nova Scotia over three years.

Currently, there is no known cure for the disease, which affects all bats that hibernate in caves and abandoned mines during the winter. There are no known bat hibernation sites with the Eastern Shore Ecodistrict, although sightings of bats have been reported.

Reptiles

One reptile species at risk, wood turtle, is known to the Eastern Shore Ecodistrict. Wood turtle is listed as threatened under both the federal SARA and the NSESA. Wood turtles are uncommon province-wide, with the majority of observations occurring in a few main concentration areas, none of which are located within the ecodistrict. Such a concentration is associated with each of the Musquodoboit River and St. Marys River systems, which run through the Eastern Shore Ecodistrict, although most wood turtle occurrences are observed much further inland.

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.

Seven of the 19 ecosections (ICKK, IFHO, IMKK, IMSM, PMHO, WCDM, and WFHO) each comprise less than 2% of the ecodistrict (Appendix 3, Table 2).

This high number of uncommon ecosections is expected for a couple of reasons. First, due to the narrowness its substantial length of almost 250 kilometres, the Eastern Shore Ecodistrict crosses many different geological and surficial physiographic features that give rise to an abundance of ecosections. Second, three ecosections – IMHO, WCKK, and WMKK – make up almost 53% of the ecodistrict.

Three ecosections – WFDM, IFHO, and WFHO – have the highest land use pressures within the ecodistrict with 24 to 34% converted to human settlement, farming, and other development activities. This is expected since the underlying fine-textured soils would have been the most productive for early settlement and farming in an ecodistrict with relatively poor soils.

Table 9 – Elements, Ecosections, Disturbance Regimes and Climax Types

820 Eastern Shore Ecodistrict

Landscape Element and Type	Ecosections*	Dominant Natural Disturbance Regime	Dominant Climax Type
Coastal Barrens (Co-Matrix)	ICHO, ICKK, WCHO, WCKK, WCRD	Open Seral	black spruce (bS), red maple (rM)
Coastal Spruce (Co-Matrix)	IFHO, IMHO, IMKK, WFHO, WMHO	Frequent	balsam Fir (bF), bS, white Spruce (wS)
Coastal Mixedwood Hills and Drumlins (Patch)	WCDM, WFDM, WMDM	Frequent	bF, rM, white birch (wB), yellow birch (yB)
Coastal Mixedwood Hills (Patch)	WMKK	Frequent	bF, bS, wS, rM, wB, yB
Coastal Spruce Flats (Patch)	IMSM	Frequent	bS, bF
Coastal Spruce Ridges (Patch)	IMRD, WMRD	Frequent	bS, wS
Wetlands (Patch)	PMHO, WTLD	Open Seral	bS, tamarack (tL), rM
Salt Marsh (Patch)	XXMS	Open Seral (tidal flooding)	*Spartina spp.* (cordgrass)
Coastal Beach (Patch)	XXCB	N/A	
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 Topographic Pattern

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

Additional representation is required in a number of these community types although opportunities are limited because of present level of Crown ownership and high conversion rates related to the area or ecosection (e.g. IFHO, WFDM, and WFHO).

The draft Code of Forest Practices recommends that over 40% of ecosections with frequent stand-initiating disturbance regimes be maintained in late successional stands. If these objectives are met, there will be adequate deer wintering habitat. If 40% of the forest is not in the late successional stage, management of these areas should conform to the special management practices for deer wintering areas.

Opportunities for future management are to implement existing policies and develop additional, effective practices to address fine filter conservation issues such as:

- Protection of uncommon forest species for which genetic viability may be threatened as indicated by DNR's Endangered Species Rating System.
- Implementation of fine filter management opportunities related to conservation of significant habitats such as the jack pine communities on the coastal barrens near Peggys Cove and near Canso.
- Recognition of uncommon community conditions (e.g. old age, large live and dead trees and species associations) and increase representivity in uncommon old forest communities.
- Implementation of restorative measures in community types such as red maple, white birch, and yellow birch on drumlins where conversion to other species or uses is high.

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 IRM classification to include old forest, Eastern Habitat Joint Venture Sites, non-designated provincial park reserves, and non-designated sites of ecological significance.

A total of about 33,125 hectares of Crown land has been set aside under legal and policy reserves within the Eastern Shore Ecodistrict. This total includes 6,906 hectares of old forest under the Old Forest Policy and in three wilderness areas – Canso Coastal Barrens and Bonnet Lake Barrens, which are totally within the ecodistrict, and Terence Bay which is only partially within this ecodistrict.

In addition, there are also 797 hectares of legal reserves designated under the Canadian Heritage River program along the St. Marys River.

Off-shore islands currently part of the Eastern Shore Island Wildlife Management Area are of interest to the Colin Stewart Forest Forum. Other scattered locations in the ecodistrict include areas near Terence Bay, Liscomb Point, Country Harbour Head, and New Harbour Head. Additional representation could come from private lands in the form of Eastern Habitat Joint Venture programs, Nature Conservancy of Canada, and Nova Scotia Nature Trust.

Priority sites and strategies to improve representation should include:

- Conservation of the hardwood climax community type of red maple and yellow birch, a notable ecosystem within predominant softwood forests, which occurs on well-drained drumlins of fine and medium-textured soils (WFDM and WMDM). This community type comprises 6% of the ecodistrict with less than 7% in protected status.

ELA Summary

Element Interpretation (All appendices and maps)

The Eastern Shore Ecodistrict is a narrow, coastal-influenced landscape that extends from St. Margarets Bay in the west to the town of Canso in the east. The area is dominated by the metasedimentary rocks with intrusions of plutonic rocks occurring at the west and east ends of the ecodistrict.

There are several faults in the ecodistrict that run approximately north-south with most occurring at the west end associated with the plutonic rocks.

Overlying the bedrock in most parts of Eastern Shore Ecodistrict are glacial deposits of ground moraine and streamlined drift along with recent sediments. These contribute to the development of soils and have been used as a source of aggregate. Many drumlins occur throughout the ecodistrict, helping shape the topography.

The coastal forests of the ecodistrict are primarily coniferous with an overstory dominated by black spruce and balsam fir with a lesser component of white spruce. Red maple and white birch occupy an intermediate position in the canopy and will only express dominance on sheltered sites with deep, well-drained soils or on sites greater than one to two kilometres from the coast.

White spruce will form pure stands on sites previously disturbed by settlement activities such as farming and on severely exposed headlands will form krummholz, a severely stunted forest condition due to constant exposure to coastal winds.

Jack pine occurs on the granite barren lands of the Chebucto and Chedabucto peninsulas indicating that drought and fire have played a role in this part of the ecodistrict.

Limitations to growth, imposed by both the local climate (e.g. salt spray, exposure to winds, cool temperatures) and soil and site influences, such as moisture deficit and excess, and low nutrient availability give rise to a boreal-like forest of balsam fir and black spruce.

Frequent natural disturbances include hurricanes, winter storms, and to a lesser extent fire and insects, which maintain an even-aged forest condition over much of the ecodistrict.

Insect defoliation has not been a significant factor in forest disturbance although the balsam woolly adelgid is currently damaging and causing mortality in balsam fir forests throughout the ecodistrict.

The outer estuary of Musquodoboit Harbour is a Ramsar site, a wetland of international importance. This and other harbours in the ecodistrict are important wintering areas for waterfowl.

The endangered roseate tern has been reported from several sites in the ecodistrict. In recent years they have bred on Country Island, which is the second most important colony of this species in Canada. The endangered piping plover nests on beaches in the ecodistrict. This ecodistrict is probably the most important one in the province for breeding eiders. Several species of seabirds nest on islands in the ecodistrict. Great blue herons nest on some of the islands. Bird colonies on islands are not likely to be disturbed by forestry, but special management practices for herons should be followed if necessary.

Coastal Spruce

(Co-Matrix) (IMHO, WMHO, IMKK, WFHO, IFHO ecosections) (42,467ha)

The Coastal Spruce matrix element is continuously being shaped by the frequent stand-initiating disturbances, predominantly hurricanes and year-round wind storms that are so prevalent along the Atlantic coastline. Forest management has also influenced the composition of the element but the quality of the forest has limited intensive use. Coastal settlement supporting the fishery has had some localized impact, especially where sheltered harbours provide refuge from the climatic extremes of the coastal ecoregion.

Exposure and climate differentiate this coastal matrix forest of softwood stands of white and black spruce and balsam fir from the inland Acadian Forest. Hardwood species, such as red maple and white birch, only form part of the canopy on inland and sheltered sites. The softwood covertype makes up 88% of the element while mixedwood comprises 6% and the hardwood type, 1%. The remaining 5% of the Coastal Spruce element is unclassified. In this element, it is common to find eastern larch on imperfectly to poorly drained soils and white pine can occasionally be found in sheltered locations.

Flows

Human (forestry, mineral exploration and development, on-shore receiving of oil/gas, recreation, hunting, off-highway vehicles (OHV)); deer (seasonal cover/foraging, wintering areas); migratory birds (coastal estuaries, breeding), seabirds (nesting); fish (Atlantic salmon runs).

Composition

Eastern Shore Ecodistrict 820 (based on statistics up to 2006)

Composition of Coastal Spruce

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	20%	37%	43% (25 Mat + 18 OF)	18%
Seral Stage	Early	Mid	Late	Unclassified
	2%	5%	82%	11%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	88%	1%	6%	5%

Desired Condition

Spruce and balsam fir-dominated softwood stands in a variety of area sizes, development stages, and seral stages consistent with a forest that is being frequently disturbed.

Issues

- With 57% of the forest area in the establishment and young competing development classes, the area of mature forest should be monitored to ensure that levels stay within the desirable range. Mature forest levels could be higher due to age calculation methodology
- Forest area in reserve is 6%, of which most is Crown land. Crown ownership represents 38% of this element.

Coastal Barrens

(Co-Matrix) (WCKK, WCHO, ICHO, WCRD, ICKK ecosections) (56,203 ha)

Barrens and woodlands form a co-matrix element found primarily on the Chebucto and Chedabucto peninsulas that jut out into the Atlantic Ocean and therefore receive the full impact of the coastal climate extremes.

Coarse-textured, imperfectly to well-drained soils derived from granite glacial till underlay the shrub lands and forests of this element. The hummocky to ridged terrain is peppered with large granite boulders which overtop the stunted spruce and woody shrubs.

Natural wildfires in the past have occurred on this landscape, negatively impacting the already nutrient-poor granitic soils. Jack pine, a fire-dependent species, can be found scattered throughout this element. Repeated fires of a more frequent occurrence during settlement have slowed any natural improvement of site conditions.

Barrens and open woodlands of spruce continue to dominate this landscape although fire suppression has allowed a slow recovery to forested conditions on some sites.

This element has the highest EEI at 78 to 79, which is a reflection of the low forest quality available for harvesting as well as the inability of the poor soils to sustain settlement and agriculture. The high index is also due to the 32% of area that is protected.

Flows

Human (forestry, mineral exploration and development, recreation, tourism, hunting, OHV); deer (foraging, travel areas); moose (travel, food); seabirds (nesting).

Composition

Eastern Shore Ecodistrict 820 (based on statistics up to 2006) **Composition of Coastal Barrens**				
Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	14%	54%	32% (15 Mat + 17 OF)	17%
Seral Stage	Early	Mid	Late	Unclassified
	4%	13%	80%	3%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	75%	7%	17%	1%

Desired Condition

The abundant barrens and sparsely forested woodlands are a product of a natural fire disturbance regime on a landscape that can have a scarcity of rainfall. This condition has been enhanced by post-settlement fires at a shorter frequency but mitigated in the last century by fire suppression efforts. Continuation of the barrens and woodlands is required to maintain the biodiversity dependent on this element.

Issues

- Fire suppression may be changing the composition of this element.
- Statistics indicate that 68% of the forest is in the establishment to young development classes (i.e. less than 40 years old). The reason for the apparent overabundance of young forest is due to the way age is calculated based on height and land productivity. Mature forest levels are most likely to be significantly higher than the current 32%.
- Crown land is 32% of the element.
- Fifty-six percent of Crown land is protected.

Coastal Mixedwood Hills

(Patch) (WMKK ecosection) (26,717 ha)

This element occurs on almost 17% of the ecodistrict with most of the occurrences between Jeddore Harbour and New Harbour. The element has both the spruce fir forest of the exposed headlands and the red maple, white birch, and balsam fir mixedwoods of inland locales with yellow birch on the more sheltered inland locations.

Underlying these forests are well-drained, medium-textured soils derived from quartzites and slates.

As with other forests along the coast, this element is being continuously shaped by the frequent stand-initiating disturbances, predominantly hurricanes and year-round wind storms. Settlement has cleared some of the forest along the inland harbours where this element occurs and when these lands are abandoned forests of white spruce are common. Forest development classes for this element are all within the desired range.

Flows

Human (forestry, recreation, hunting); deer (seasonal cover/foraging, wintering areas); seabirds (nesting); raptors (nesting, perching).

Composition

Eastern Shore Ecodistrict 820 (based on statistics up to 2006)

Composition of Coastal Mixedwood Hills

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	25%	29%	46% (33 Mat + 13 OF)	13%

Seral Stage	Early	Mid	Late	Unclassified
	3%	10%	68%	19%

Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	75%	4%	13%	8%

Desired Condition

Two conditions are supported on the Coastal Mixedwood Hills element: where coastal exposure is more severe, forests of black and white spruce and fir are dominant; where hills are inland and protected from the coastal elements, mixedwood forests of red maple and white birch and occasionally yellow birch, with balsam fir and white spruce are appropriate.

Issues

- Only 6% of the element is protected, mainly on Crown lands.
- Crown ownership is 32% of the element.

Coastal Spruce Ridges

(Patch) (WMRD and IMRD ecosections) (17,533 ha)

The forest condition of this large patch element is similar to the matrix Coastal Spruce but occurs on bedrock-ridged terrain. Forests are very susceptible to the winds with open woodlands of stunted black spruce interspersed where soils are very shallow over bedrock.

Similar soil and terrain conditions exist on the offshore islands between Clam Harbour and Ecum Secum where wind-swept forests of black spruce and white spruce are dominant. The occurrence of red maple and white birch in the canopy is limited to only the best of the sheltered sites. Wetland forests of black spruce and tamarack are embedded within this element, which is frequently disturbed by windthrow and/or natural senescence that limit the potential for old growth forest development.

The forest covertypes are the same as the Coastal Spruce, with 88% softwood, which illustrates the significant impact of the coastal climate on hardwood development into the

overstory. Windswept forests of a krummholtz appearance can be found on the offshore islands and headlands. Windthrow is a significant disturbance in this element due to the shallow soils over bedrock.

The EEI is 70 to 74 which is comparable to the Coastal Spruce matrix of 68 to 72, indicating that land management practices are sustaining ecological integrity of the element.

Flows

Human (forestry, mineral exploration and development, recreation, hunting); deer (seasonal cover/foraging, wintering areas); seabirds (nesting).

Composition

Eastern Shore Ecodistrict 820 (based on statistics up to 2006)
Composition of Coastal Spruce Ridges

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	16%	30%	54% (26 Mat +28 OF)	28%
Seral Stage	Early	Mid	Late	Unclassified
	1%	5%	82%	12%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	88%	2%	5%	5%

Desired Condition

A softwood-dominated patch type with a mixture of development classes and seral stages consistent with frequent stand-initiating disturbances.

Issues

- Forest management activity is limited in this element due to soil and site issues as well as by the low productivity of the sites.
- Much of this element is on offshore islands which are critical for seabird nesting.
- Mature forest levels could be higher due to age calculation methodology (see explanation under Coastal Barrens).

Coastal Mixedwood Hills and Drumlins

(Patch) (WMDM, WFDM and WCDM ecosections) (12,321 ha)

Providing some of the best growing conditions in this coastal ecodistrict, drumlins have been preferred for settlement. This element occurs from one end to the other of the ecodistrict as small isolated patches. Black and white spruce with balsam fir are the dominant forest on sites exposed to the ocean, but slightly further inland and on more sheltered sites mixedwood forests of yellow and white birch, red maple, and balsam fir are possible. These glacial deposits of unsorted till are well drained and usually have a higher inherent fertility than the surrounding terrain.

As with all forests along the coast, this element is also being continuously shaped by the frequent stand-initiating disturbances, predominantly hurricanes and year-round wind storms. Settlement has cleared much of the natural forest, and when cleared land is abandoned forests of white spruce are common.

Forest development classes for this element are all within the desired range.

The Ecological Emphasis Index of this patch element is the lowest of all elements within this ecodistrict with a range of 60 to 64. This still indicates a high level of ecological integrity.

Flows

Human (forestry, recreation, hunting); deer (seasonal cover/foraging, wintering areas); seabirds (nesting); raptors (nesting, perching).

Composition

Eastern Shore Ecodistrict 820 (based on statistics up to 2006)
Composition of Coastal Mixedwood Hills and Drumlins

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	19%	30%	51% (34 Mat + 17 OF)	17%
Seral Stage	Early	Mid	Late	Unclassified
	3%	12%	73%	12%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	75%	5%	15%	5%

Desired Condition

Two conditions are supported on the drumlin element. Where coastal exposure is more severe, forests of black and white spruce and fir are dominant. Where drumlins are protected from the coastal elements, mixedwood forests of red maple and white birch and occasionally yellow birch, with balsam fir and white spruce are appropriate.

Issues

- Crown ownership is 18%, mostly in the least productive ecosection, WCDM, in which there are coarse-textured soils of low fertility.
- Approximately 9% of the element is protected, all on Crown lands.

Wetlands
(Patch) (WTLD and PMHO ecosections) (4,778 ha)

Wetlands is a patch element occupying 3% of the ecodistrict. However, many smaller wetlands are embedded in other coastal elements and the total area is significantly larger than the mapped total. Freshwater bogs, fens, swamps, and poorly drained depressions and flat terrain account for most

of the element. The cool, moist coastal climate also enhances water retention on many sites contributing to year-round water excess.

Wetlands are not always associated with level and depressional terrain. Often they are located on slopes where water drainage has been impeded by underlying bedrock ridges. Wetlands are generally treeless areas of ericaceous shrubs such as kalmia, leatherleaf, Labrador tea, and rhodora.

When wetlands are sparsely forested, black spruce and tamarack are common. Soils are generally organic and derived from sphagnum mosses.

Wetlands are important to wildlife and often provide habitat for uncommon plants. This element is critically important for water collection, filtering, and groundwater recharge.

Flows

Human (recreation, hunting, fishing, OHV traffic-when used to access hunting and fishing areas can cause a great deal of damage); deer (seasonal cover/foraging, wintering areas, deer that often pass through the wetland complexes in their travels from the interior to the coast); seabirds (nesting).

Composition

Eastern Shore Ecodistrict 820 (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
	17%	43%	40% (18 Mat + 22 OF)	22%
Seral Stage	Early	Mid	Late	Unclassified
	4%	7%	79%	10%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	89%	2%	4%	5%

Desired Condition

Undisturbed bog and fen complexes with patches of black spruce on the better-drained hummocks would be the desired condition.

Issues

- Wetlands patch element is found dispersed across the ecodistrict and the nature of the wetlands raises issues around road development, infilling, and drainage.
- Indiscriminate OHV use is harming sensitive wetland complexes. Public education on wetland ecological value is required. Developing ecosystem management techniques to ensure the conservation of this element will be required.
- Forty-two percent of the element is privately owned.

Coastal Spruce Flats

(Patch) (IMSM ecosection) (674 ha)

This small patch element, often linear in shape due to its association with riparian zones and lakeshores, is scattered throughout the ecodistrict. Wet forests of black spruce, tamarack, and red maple are common. Occasionally this element is found on imperfectly drained soils associated with level terrain on flat hills. These forests are important in water collection, filtering, and groundwater recharge.

Flows

Human (hunting, forestry); deer (seasonal cover/foraging, wintering areas); seabirds (nesting).

Composition

Eastern Shore Ecodistrict 820 (based on statistics up to 2006)

Composition of Coastal Spruce Flats

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	16%	72%	12% (8 Mat + 4 OF)	4%
Seral Stage	Early	Mid	Late	Unclassified
	1%	1%	90%	8%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	94%	1%	2%	3%

Desired Condition

Intact wet forests of black spruce, tamarack, and red maple are preferred with disturbance from harvesting restricted to times when soils are less sensitive to rutting and compaction.

Issues

- Sites are sensitive to disturbance from forest harvesting.
- OHV use can cause significant damage to soils.

Coastal Beach

(Patch) (XXCB ecosection) (656 ha)

The Eastern Shore Ecodistrict is renowned for its sandy beaches, bringing tourists and surfers to this part of Nova Scotia year round. The beaches are also home to several endangered seabirds, including the piping plover and roseate tern.

Late seral white and black spruce are usually found associated with the coastal beach systems. Beach grasses help to stabilize the dune systems.

Barrier beaches, such as the ones at Cow Bay and Lawrencetown, often enclose brackish water in lagoons and lakes. These provide important seabird habitat.

Flows

Human (recreation, camping, hiking, hunting); water (Coastal ponds, marine estuaries); deer (winter habitat and feeding); furbearers (travel, food, habitat), migratory waterfowl (travel routes, summer habitat).

Composition

Eastern Shore Ecodistrict 820 (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
	28%	47%	25% (12 Mat + 13 OF)	13%
Seral Stage	Early	Mid	Late	Unclassified
	0%	0%	87%	13%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	94%	0%	0%	6%

Desired Condition

Natural beach systems with minimal human impact to dunes, lagoons (brackish water lakes and ponds) will ensure long-term integrity of these fragile ecosystems.

Issues

- Crown ownership is only 36% of the element.
- Only 24% of this sensitive and iconic element is protected although some beaches are under the Protected Beaches Act.
- Two endangered bird species, piping plover and roseate tern, use this element for nesting and are very sensitive to human disturbance/presence/traffic.
- Indiscriminate OHV use on dune systems resulting in the destruction of wildlife habitat and plant communities.
- Development of beach complexes – residential, can threaten both wildlife and their habitat.
- Use of beach materials for aggregates can threaten beach stabilization and/or infrastructure associated with beach developments.
- Coastal erosion due to rising sea levels.

Salt Marsh

(Patch) (XXMS ecosection) (279 ha)

The Salt Marsh element makes up a small but unique habitat patch with areas of salt marsh scattered along the eastern shore, most notably from Cole Harbour to Clam Harbour and elsewhere.

Primary production from photosynthesis in salt marshes is exceedingly high, even in temperate latitudes. Resulting nutrient enrichment from growth of plants and marine algae supports a rich and diverse assemblage of aquatic invertebrates and fish. Salt marshes also support migratory birds, shorebirds, waterfowl, terns, herons, ospreys, and eagles, as well as furbearers such as otter and mink.

Although there has been a long history of loss of salt marsh throughout Nova Scotia, particularly through dyking and conversion to farmland, this has not occurred along the eastern shore although salt marshes have been disrupted due to other activities such as transportation, harbour development, and right of ways.

Flows

Human (fishing, trapping, settlement, roads, harbour development); water (coastal ponds, marine estuaries); deer (winter habitat and feeding); furbearers (travel, food, habitat); migratory birds (travel routes, summer habitat); seabirds (nesting).

Composition

Eastern Shore Ecodistrict 820 (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
	3%	33%	64% (33 Mat + 31 OF)	31%
Seral Stage	Early	Mid	Late	Unclassified
	0%	10%	90%	0%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	88%	0%	12%	0%

Desired Condition

A natural salt marsh ecosystem with a minimum of human intervention is preferred.

Issues

- Crown ownership is only 0.1% of the element.
- All Crown land is protected but total protection is only 0.1%.
- Salt marshes are critical habitat.

Valley Corridors

(Corridor) (Various ecosections) (324 ha)

Corridors in the Eastern Shore Ecodistrict are a continuance of inland linear corridors associated with the larger rivers that empty into the Atlantic Ocean. These corridors are often shaped by long inland harbours, coves, and bays, such as New Harbour, Liscomb Harbour, and Prospect Bay. All the corridors provide important linkages within the ecodistrict and among adjacent ecodistricts.

The East Branch Indian River is a good example of an inland-coastal connection. The use of corridors by terrestrial wildlife can be seasonal as food and shelter conditions change.

These corridors are also used extensively by people to access both inland resources, such as forests and minerals, and to harvest the resources of the ocean. The interface between salt water and fresh water is critical for anadromous fish species, especially the endangered Atlantic salmon. These corridors also include significant estuary habitat, critical for migratory birds.

Most of these corridors include forested elements dominated by the Coastal Spruce and Coastal Mixedwood Hills elements. Along the inland harbours, slopes are steep to the water's edge.

Tree species are predominantly balsam fir, white spruce, and black spruce and on the sheltered slopes red maple and white birch and occasionally yellow birch. Land use has resulted in some land being converted to other uses along these corridors, especially for settlement, transportation, and resource development. The EEI is 57, the lowest in the ecodistrict.

Flows

People (recreation, fishing, hunting, exploration, transportation); deer (travel, food, water, cover); trout (habitat); Atlantic salmon (access to spawning beds, habitat); eagles (nesting, food from rivers); migratory birds (breeding, resting); seabirds (nesting, feeding, habitat).

Composition

Eastern Shore Ecodistrict 820 (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
	1%	33%	66% (44 Mat + 22 OF)	22%
Seral Stage	Early	Mid	Late	Unclassified
	1%	18%	80%	1%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	75%	4%	21%	0%

Desired Condition

Sufficient natural forest cover to maintain flows for wildlife with no restrictions/impairments to connectivity within the ecodistrict or among ecodistricts.

Issues

- Significant land conversion in localized areas is restricting connectivity.
- A large percentage of the corridor area is privately owned, limiting management options.
- Corridors are also a primary route for roads and utilities.

Ecosystem Issues and Opportunities (All appendices and maps)

Management of the forest resource in the Eastern Shore 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:

- Maintenance of the low to moderate land use intensity as indicated by the EEI value of 71 to 74 for the ecodistrict and ranging from 68 to 79 for the co-matrix elements.
- Additional Crown lands are of interest as wilderness areas as part of the 12% provincial initiative, including many which make up the Eastern Shore Islands Wildlife Management Area.
- Maintenance of connectivity with inland ecodistricts due to the seasonal importance of the coastal habitat for many terrestrial wildlife species.
- Provision of shoreline access for wildlife in areas where settlement has created significant barriers, such as urban/residential development and transportation corridors.
- Limiting alterations of areas in and around salt marshes and coastal beaches.
- Attempting to acquire more land along the coast to ensure public access.
- Reducing land conversion.

Appendix 1: Flow - Element Interactions

Element	People	Deer	Anadromous Fish	Migratory Birds	Seabirds	Black Bear
Co-Matrices Coastal Spruce	Forestry, Access Roads, Mineral Exploration, Outdoor Recreation (hunting, fishing, hiking, OHVs)	Primary habitat, Wintering areas, Travel ways	Water quality maintenance, riparian habitat (e.g. stream cooling, undercut banks)	---	Nesting, roosting	Seasonal habitat, foraging
Coastal Barrens	Forestry, Access Roads, Mineral Exploration, Outdoor Recreation (hunting, fishing, hiking, OHVs)	Travel ways	Water quality maintenance, riparian habitat	---	Nesting, roosting, feeding	Seasonal habitat, foraging - berries
Patches Coastal Mixedwood Hills and Drumlins	Forestry, Access Roads, Mineral Exploration, Outdoor Recreation (hunting, fishing, hiking, OHVs)	Primary habitat, Foraging areas, Travel ways	Water quality maintenance, riparian habitat	---	---	Seasonal habitat, foraging
Coastal Mixedwood Hills	Forestry, Access Roads, Mineral Exploration, Outdoor Recreation (hunting, fishing, hiking, OHV's)	Primary habitat, Foraging areas, Travel ways	Water quality maintenance, riparian habitat	---	---	Seasonal habitat, foraging
Coastal Spruce Flats	Forestry, Access Roads, Mineral Exploration, Outdoor Recreation (hunting, fishing, hiking, OHVs)	Wintering areas, Travel ways	Water quality maintenance, riparian habitat	---	Nesting, roosting, feeding	Seasonal habitat, foraging
Coastal Spruce Ridges	Forestry, Access Roads, Mineral Exploration, Outdoor Recreation (hunting, fishing, hiking, OHVs)	Travel ways	Water quality maintenance, riparian habitat	---	Nesting, roosting, feeding	Seasonal habitat, foraging

Appendix 1: Flow - Element Interactions

Element	People	Deer	Anadromous Fish	Migratory Birds	Seabirds	Black Bear
Salt Marsh	Hunting	Minor foraging	Nutrient enrichment through primary production (photosynthesis), prey habitat	Seasonal habitat, migratory resting, foraging	Nesting, habitat, feeding	---------
Coastal Beach	Recreation	---------	Ephemeral barrier (barrier beaches)	Seasonal habitat, migratory resting, foraging	Nesting, habitat, feeding	---------
Wetlands	Hunting	Foraging, habitat, fawning	Water quality maintenance, nursery areas, cover	Seasonal habitat, migratory resting, foraging	Nesting, habitat, feeding	---------
Corridor Valley Corridors	Forestry, Access Roads, Mineral Exploration, Outdoor Recreation (hunting, fishing, hiking, OHVs)	Travel ways, foraging	Water quality maintenance, riparian habitat	---------	---------	Travel ways

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 Spruce	Co-Matrix	Low	Moist and mossy, dense spruce fir forests	Dominant feature of landscape	Frequent	bF, bS, wS	Drumlin landforms, well-drained hummocks and hills. Wetlands.	None.	Maintenance of connectivity to the shoreline. Conservation of deer wintering areas.	Stand-level disturbances with patch sizes similar to those created naturally.
Coastal Barrens	Co-Matrix	Low	Occurrences of jack pine near Peggys Cove and Canso.	Dominant feature on the Chebucto and Chedabucto peninsulas	Frequent	bS, rM	Wetlands and spruce fir hummocks.	None.	Protection of watercourses and wetlands. Loss of fire as a renewal agent. OHV travel.	Renewal of fire ecosystems. Design of recreational access for OHV.
Coastal Mixedwood Hills and Drumlins	Patch	Moderate	Concentrated near Clam Harbour, Moser River, Indian Harbour Lake		Frequent	bF, rM, wB, yB	Spruce fir forests on moister sites.	Conversion to other land uses.	Conservation of deer wintering areas.	Stand-level disturbances with patch sizes similar to those created naturally.

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 Mixedwood Hills	Patch	Moderate	Similar conditions on headlands tend to be spruce fir-dominated.	Landscape wide. Forestry to mimic patch-level stand disturbances.	Frequent	bS, bF, wS, rM, yB, wB	Spruce fir forests on moister sites.	Transportation and utility corridors.	Conservation of deer wintering areas.	Stand-level disturbances with patch sizes similar to those created naturally.
Coastal Spruce Flats	Patch	Low	A complex of wetlands and spruce flats, e.g. Seal Harbour Marshes.	Local, areas sensitive to stand-level disturbance.	Frequent	bS, bF	Wetlands associated with lakes and rivers or streams.	Wet soils.	Water quality, site sensitivity to disturbance.	Seasonal access for harvesting to reduce site impacts. Stand-level disturbances.
Coastal Spruce Ridges	Patch	Low	Offshore islands - Eastern Shore Wildlife Management Area	Typical of the shoreline from Jeddore to Marie Joseph	Frequent	bS, wS	Open water or shoreline exposure.	Off-shore islands. Ridged, rocky terrain.	Exposure. Shallow soils over bedrock. Windthrow.	Create stand-level disturbances due to windthrow hazard.

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
Salt Marsh	Patch	High	Large marshes near Lawrencetown, Chezzetcook, Marie Joseph	Isolated local patches of unique habitat	Open Seral (tidal)	Saltwater cordgrass	Ridged bS forests. Coastal beaches.	Water flow obstructions (alter fresh water and salt water contact), alteration of marsh and adjoining habitat, sedimentation.	Infilling and loss. Degradation due to land use.	Conserve and protect from offsite pollutants.
Coastal Beach	Patch	High	Clam Harbour Beach, Lawrencetown Beach, Martinique Beach	Common from Cole Harbour to Sheet Harbour with fewer occurrences to Canso.	n/a	----------	Salt marshes and ridged topography with bS forests.	Local loss due to development, impacts due to OHV damage.	Loss of wildlife habitat for endangered species.	Conserve and protect.

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
Wetlands	Patch	Moderate	Quinces Glades, Fowlers Lake Bog. Underlain with organic soils.	Landscape level. Areas treeless bogs.	Open Seral (Frequent)	bS, tL, rM	Late seral softwood forests of bS and bF. Watercourses.	Isolation due to road construction.	Conservation of wetland function, i.e. water quality. Species at risk. OHV damage.	Maintain appropriate machine exclusion zones.
Valley Corridors	Corridor	Moderate	Long narrow harbours and inlets linking the coastal and inland ecodistricts. East Branch Indian River corridor.	Linear connectors with the coastal and inland environments.	Frequent	Riparian forests of bF, bS, wS, rM	Late seral bS/bF forest, mixedwood forests of rM, wB, and bF.	Fragmentation and continuity of connectivity.	Sedimentation and water quality degradation. Habitat loss.	Maintain appropriate riparian and machine exclusion zones. Reduce road access through corridors.

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 natural disturbance regime (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 key patch 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 820)

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
Piping Plover melodus ssp	*Charadrius melodus melodus*	Endangered	Endangered	Endangered
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Threatened	Threatened
Rusty Blackbird	*Euphagus carolinus*	Endangered	Special Concern	Special Concern
Peregrine Falcon - anatum/tundrius	*Falco peregrinus pop. 1*	N/A	Special Concern	Special Concern
Barn Swallow	*Hirundo rustica*	Endangered	N/A	Threatened
Harlequin Duck - Eastern population	*Histrionicus histrionicus pop. 1*	Endangered	Special Concern	Special Concern
Savannah Sparrow princeps ssp	*Passerculus sandwichensis princeps*	N/A	Special Concern	Special Concern
Bank Swallow	*Riparia riparia*	N/A	N/A	Threatened
Roseate Tern	*Sterna dougallii*	Endangered	Endangered	Endangered
Buff-breasted Sandpiper	*Tryngites subruficollis*	N/A	N/A	Special Concern
Canada Warbler	*Wilsonia canadensis*	Endangered	Threatened	Threatened
DICOTS				
Black Ash	*Fraxinus nigra*	Threatened	N/A	N/A
GYMNOSPERMS				
Eastern White Cedar	*Thuja occidentalis*	Vulnerable	N/A	N/A
FISH				
Atlantic Salmon - Southern Upland population		N/A	N/A	Endangered
INSECTS				
Monarch	*Danaus plexippus*	N/A	Special Concern	Special Concern
LICHENS				
Blue Felt Lichen	*Degelia plumbea*	Vulnerable	Special Concern	Special Concern
Boreal Felt Lichen - Atlantic population	*Erioderma pedicellatum (Atlantic pop.)*	Endangered	Endangered	Endangered
MAMMALS				
Moose	*Alces americanus*	Endangered	N/A	N/A
Little Brown Myotis	*Myotis lucifugus*	Endangered	N/A	Endangered
REPTILES				
Wood Turtle	*Glyptemys insculpta*	Threatened	Threatened	Threatened

Appendix 3: Special Occurrences (Ecodistrict 820)

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			
Spotted Sandpiper	*Actitis macularius*	Sensitive (Yellow)	S3S4B
Gadwall	*Anas strepera*	May Be At Risk (Orange)	S2B
American Bittern	*Botaurus lentiginosus*	Sensitive (Yellow)	S3S4B
Purple Sandpiper	*Calidris maritima*	Sensitive (Yellow)	S3N
Least Sandpiper	*Calidris minutilla*	Secure (Green)	S1B,S5M
Semipalmated Sandpiper	*Calidris pusilla*	Sensitive (Yellow)	S3M
Pine Siskin	*Carduelis pinus*	Sensitive (Yellow)	S3S4B,S5N
Turkey Vulture	*Cathartes aura*	Sensitive (Yellow)	S2S3B
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
Blackpoll Warbler	*Dendroica striata*	Sensitive (Yellow)	S3S4B
Gray Catbird	*Dumetella carolinensis*	May Be At Risk (Orange)	S3B
Yellow-bellied Flycatcher	*Empidonaxflaviventris*	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
Hudsonian Whimbrel	*Numenius phaeopus hudsonicus*	Sensitive (Yellow)	S3M
Fox Sparrow	*Passerella iliaca*	Secure (Green)	S3S4B
Gray Jay	*Perisoreuscanadensis*	Sensitive (Yellow)	S3S4
Great Cormorant	*Phalacrocorax carbo*	Sensitive (Yellow)	S3
Red Phalarope	*Phalaropus fulicarius*	Sensitive (Yellow)	S2S3M
Red-necked Phalarope	*Phalaropus lobatus*	Sensitive (Yellow)	S2S3M
Rose-breasted Grosbeak	*Pheucticusludovicianus*	Sensitive (Yellow)	S3S4B
Black-backed Woodpecker	*Picoides arcticus*	Sensitive (Yellow)	S3S4
Pine Grosbeak	*Pinicola enucleator*	May Be At Risk (Orange)	S3?B,S5N
American Golden-Plover	*Pluvialis dominica*	Sensitive (Yellow)	S3M
Boreal Chickadee	*Poecile hudsonica*	Sensitive (Yellow)	S3
Purple Martin	*Progne subis*	May Be At Risk (Orange)	S1B
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

Appendix 3: Special Occurrences (Ecodistrict 820)

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***
Tennessee Warbler	*Vermivora peregrina*	Sensitive (Yellow)	S3S4B
Warbling Vireo	*Vireo gilvus*	Undetermined	S1?B
BRYOPHYTES			
Coast Creeping Moss	*Conardia compacta*	Sensitive (Yellow)	S2?
Lustrous Peat Moss	*Sphagnum subnitens*	Sensitive (Yellow)	S2?
Toothed-leaved Nitrogen Moss	*Tetraplodon angustatus*	Sensitive (Yellow)	S2S3
DICOTS			
Fernald's Serviceberry	*Amelanchier fernaldii*	Undetermined	S2?
Maritime Saltbush	*Atriplex acadiensis*	Undetermined	S1?
Yellow Bartonia	*Bartonia virginica*	Secure (Green)	S3
Michaux's Dwarf Birch	*Betula michauxii*	Sensitive (Yellow)	S2
Small-flowered Bittercress	*Cardamine parviflora var. arenicola*	Sensitive (Yellow)	S2
Limestone Scurvy-grass	*Cochlearia tridactylites*	May Be At Risk (Orange)	S1
Water Pygmyweed	*Crassula aquatica*	Sensitive (Yellow)	S2
Pink Crowberry	*Empetrum eamesii*	Sensitive (Yellow)	S3
Pink Crowberry	*Empetrum eamesii ssp. atropurpureum*	Sensitive (Yellow)	S2S3
Pink Crowberry	*Empetrum eamesii ssp. eamesii*	Sensitive (Yellow)	S2S3
Common Bedstraw	*Galium aparine*	Exotic	S1
Northern Comandra	*Geocaulon lividum*	Sensitive (Yellow)	S3
Kalm's Hawkweed	*Hieracium kalmii*	Undetermined	S2?
Kalm's Hawkweed	*Hieracium kalmii var. fasciculatum*	Undetermined	S1?
Pinebarren Golden Heather	*Hudsonia ericoides*	Sensitive (Yellow)	S2
Southern Mudwort	*Limosella australis*	Sensitive (Yellow)	S3
Greenland Stitchwort	*Minuartiagroenlandica*	Sensitive (Yellow)	S2
Cursed Buttercup	*Ranunculus sceleratus*	May Be At Risk (Orange)	S1S2
Knotted Pearlwort	*Sagina nodosa*	Secure (Green)	S2S3
Seabeach Ragwort	*Senecio pseudoarnica*	Sensitive (Yellow)	S2
Sticky Goldenrod	*Solidago simplex var. randii*	Extirpated	SH
Saltmarsh Starwort	*Stellaria humifusa*	Sensitive (Yellow)	S2
Northern Blueberry	*Vaccinium boreale*	May Be At Risk (Orange)	S2
Dwarf Bilberry	*Vaccinium caespitosum*	Sensitive (Yellow)	S2
Alpine Bilberry	*Vaccinium uliginosum*	Sensitive (Yellow)	S2

Appendix 3: Special Occurrences (Ecodistrict 820)

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***
FERNS AND THEIR ALLIES			
Least Moonwort	*Botrychium simplex*	Sensitive (Yellow)	S2S3
Variegated Horsetail	*Equisetumvariegatum*	Secure (Green)	S3
Acadian Quillwort	*Isoetes acadiensis*	Sensitive (Yellow)	S3
Southern Bog Clubmoss	*Lycopodiella appressa*	Secure (Green)	S3S4
Little Curlygrass Fern	*Schizaea pusilla*	Secure (Green)	S3
INSECTS			
Mottled Darner	*Aeshna clepsydra*	Secure (Green)	S3
Lance-Tipped Darner	*Aeshna constricta*	Secure (Green)	S3
Ocellated Darner	*Boyeria grafiana*	Sensitive (Yellow)	S3
Henry's Elfin	*Callophrys henrici*	Secure (Green)	S2
Hoary Elfin	*Callophrys polios*	Secure (Green)	S3S
Baltimore Checkerspot	*Euphydryas phaeton*	Secure (Green)	4 S3
Common Branded Skipper	*Hesperia comma*	Secure (Green)	S3
Elfin Skimmer	*Nannothemis bella*	Secure (Green)	S3
Riffle Snaketail	*Ophiogomphuscarolus*	Secure (Green)	S3
Question Mark	*Polygonia*	Secure (Green)	S3B
Banded Hairstreak	*interrogationis Satyrium*	Undetermined	S2
Clamp-Tipped	*calanus*	Secure (Green)	S3
Emerald Black	*Somatochloratenebrosa*	Sensitive (Yellow)	S3
Meadowhawk	*Sympetrum danae*		
LICHENS			
Ghost Antler Lichen	*Pseudeverniacladonia*	Sensitive (Yellow)	S2S3
CoastalBushy Beard Lichen	*Usnea flammea*	Sensitive (Yellow)	S2S3
MAMMALS			
Atlantic White-sided Dolphin	*Lagenorhynchus acutus*	n/a	S3S4
Hoary Bat	*Lasiurus cinereus*	May Be At Risk (Orange)	S1
Cougar - Eastern population	*Puma concolor pop. 1*	Undetermined	SH
MONOCOTS			
Atlantic Sedge	*Carex atlantica ssp. capillacea*	Undetermined	S2
Tender Sedge	*Carex tenera*	Sensitive (Yellow)	S1S2
Sparse-Flowered Sedge	*Carex tenuiflora*	May Be At Risk (Orange)	S1
Russet Cotton-Grass	*Eriophorumchamissonis*	Secure (Green)	S3S4

Appendix 3: Special Occurrences (Ecodistrict 820)

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***
Slender Cottongrass	*Eriophorum gracile*	Sensitive (Yellow)	S2
Greene's Rush	*Juncus greenei*	May Be At Risk (Orange)	S1S2
Large Purple Fringed Orchid	*Platantheragrandiflora*	Secure (Green)	S3
Narrow-leaved Blue-eyed-grass	*Sisyrinchium angustifolium*	Secure (Green)	S3S4
Northern Burreed	*Sparganium hyperboreum*	Sensitive (Yellow)	S1S2
Yellow Ladies'-tresses	*Spiranthesochroleuca*	Sensitive (Yellow)	S2S3

*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 820)
Table 1c – Other Conservation Features

Feature	Type	Information Source	Legislation or Status Ranking System
Loon Nesting Lakes	Bird Habitat	Significant Habitats of Nova Scotia Database	Nova Scotia Environment Act Nova Scotia Forests Act (subsection: *Wildlife Habitat and Watercourses Protection Regulations*)
Eagle Nests	Bird Habitat	Significant Habitats of Nova Scotia Database	Nova Scotia Wildlife Act (NSWA)
Migratory Shorebird Roosts	Bird Habitat	Local knowledge	Nova Scotia Wildlife Act
Wilderness Areas – Terence Bay; Bonnet Lake Barrens; Canso Coastal Barrens	Ecosystems/ Recreation	DNR Restricted Land Use Database	Nova Scotia Wilderness Areas Protection Act
Provincial Park – Black Duck Cove; Tor Bay Atlantic; Marie Joseph; Spry Bay; Taylor Head; Clam Harbour Beach; Martinique Beach; Porter's Lake; Lawrencetown Beach; Conrods Beach; Rainbow Haven; Cole Harbour – Lawrencetown Coastal Heritage; McCormacks Beach; Crystal Crescent Beach; William E. deGarthe Memorial (Peggy's Cove)	Ecosystems/ Recreation	DNR Restricted Land Use Database	Nova Scotia Parks Act
Site of Ecological Significance	Ecosystems	DNR Restricted Land Use Database	Ramsar Convention
Old Forest	Ecosystems	DNR Restricted Land Use Database	

Appendix 3: Special Occurrences (Ecodistrict 820)
Table 1d – Heritage Features

Feature	Type	Information Source
Prince Henry Sinclair Monument; Halfway Cove	Cultural/Heritage	Local Knowledge
Abandoned Mines	Geological and Cultural Heritage	NS Abandoned Mines Database
National Historic Site – Grassy Island; 18th century British garrison post. (Canso)	Cultural/Community Heritage	NSDNR Restricted Land Use Database
Historic Site – Hazel Hill; Commercial Cable Company – Transatlantic Cable (Canso)	Cultural/Community 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	rockland	7,321	4.3	33,766	19.7	72 to 73	6.9	9,115	2.0	33,766	7.2	19.7	72 to 73
ICKK	rockland	149	0.1	33,766	19.7	66.0	18.0	149	0.0	33,766	7.2	19.7	66.0
IFHO	bS	587	0.3	47,255	27.5	45 to 48	34.5	7,124	1.5	86,879	18.6	27.5	45 to 48
IMHO	bS	35,315	20.6	47,255	27.5	68 to 73	4.1	129,784	27.9	86,879	18.6	27.5	68 to 73
IMKK	bS wS	853	0.5	52,069	30.3	66 to 70	5.8	2,289	0.5	64,953	13.9	30.3	66 to 70
IMRD	bS wS	10,106	5.9	52,069	30.3	68 to 73	4.6	13,717	2.9	64,953	13.9	30.3	68 to 73
IMSM	bS bF	671	0.4	1,735	1.0	76 to 79	0.7	12,363	2.7	1,735	0.4	1.0	76 to 79
PMHO	wetlands	322	0.2	0	0.0	65	13.9	20,283	4.4	0	0.0	0.0	65
WCDM	bS wS	1,501	0.9	52,069	30.3	81	1.4	1,737	0.4	64,953	13.9	30.3	81
WCHO	rockland	14,518	8.5	33,766	19.7	75 to 76	5.8	21,248	4.6	33,766	7.2	19.7	75 to 76
WCKK	rockland	28,177	16.4	33,766	19.7	82	3.5	30,806	6.6	33,766	7.2	19.7	82
WCRD	rockland	6,112	3.6	33,766	19.7	76	8.3	6,144	1.3	33,766	7.2	19.7	76
WFDM	rM yB	4,373	2.5	11,261	6.6	49 to 52	28.7	6,656	1.4	32,800	7.0	6.6	49 to 52
WFHO	bS wS	678	0.4	52,069	30.3	54	24.8	4,122	0.9	64,953	13.9	30.3	54
WMDM	rM yB	6,438	3.8	11,261	6.6	61 to 68	8.6	27,860	6.0	32,800	7.0	6.6	61 to 68

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

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	%		
WMHO	bS wS	5,071	3.0	52,069	30.3	69 to 74	5.6	37,939	8.1	64,953	13.9	60 to 64	11.6
WMKK	bS wS	26,854	15.6	52,069	30.3	64 to 72	5.1	47,030	10.1	64,953	13.9	61 to 69	6.1
WMRD	bS wS	7,457	4.3	52,069	30.3	73 to 76	2.8	11,884	2.6	64,953	13.9	70 to 71	4.1
WTLD	wetlands	4,443	2.6	0	0.0	76 to 78	0.8	14,587	3.1	0	0.0	72 to 73	2.5

*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 Reserves		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)
IMHO	bS	35,315	37.0	1,216	13.3	550	0.1	1,766	5.0	13	0.0	1,779	5.0
WCKK	rockland	28,177	64.7	11,234	7.9	419	0.0	11,654	41.4	8	0.0	11,661	41.4
WMKK	bS wS	26,854	32.4	873	7.1	668	0.0	1,541	5.7	7	0.0	1,548	5.8
WCHO	rockland	14,518	50.4	3,045	0.7	526	0.0	3,571	24.6	1	0.0	3,571	24.6
IMRD	bS wS	10,106	33.0	336	13.2	601	0.0	937	9.3	13	0.1	950	9.4
WMRD	bS wS	7,457	50.1	222	0.7	728	16.6	949	12.7	17	0.2	967	13.0
ICHO	rockland	7,321	43.7	521	0.0	417	0.0	937	12.8	0	0.0	937	12.8
WMDM	rM yB	6,438	14.1	290	0.0	149	0.0	439	6.8	0	0.0	439	6.8
WCRD	rockland	6,112	55.1	1,737	0.0	194	0.0	1,931	31.6	0	0.0	1,931	31.6
WMHO	bS wS	5,071	61.0	786	0.0	1	0.0	787	15.5	0	0.0	787	15.5
WTLD	wetlands	4,443	58.1	579	0.0	60	0.0	638	14.4	0	0.0	638	14.4
WFDM	rM yB	4,373	9.1	181	3.1	8	0.0	188	4.3	3	0.1	191	4.4
WCDM	bS wS	1,501	57.3	439	0.0	8	0.0	447	29.8	0	0.0	447	29.8
IMKK	bS wS	853	14.8	7	0.1	1	0.0	7	0.9	0	0.0	7	0.9
WFHO	bS wS	678	5.3	10	0.0	5	0.0	15	2.2	0	0.0	15	2.2
IMSM	bS, bF	671	48.0	122	0.0	0	0.0	122	18.2	0	0.0	122	18.2
XXCB	coastal beach	654	36.0	103	23.7	31	0.0	134	20.5	24	3.6	158	24.1
IFHO	bS	587	1.7	10	0.0	0	0.0	10	1.7	0	0.0	10	1.7
PMHO	wetlands	322	0.0	0	0.0	0	0.0	1	0.2	0	0.0	1	0.2
XXMS	salt marsh	277	0.1	15	2.0	4	0.0	19	0.1	2	0.0	21	0.1
ICKK	rockland	149	0.2	0	0.0	29	0.0	29	0.2	0	0.0	29	0.2
Total		**161,877**		**21,725**	**72**	**4,397**	**17**	**26,122**		**89**		**26,210**	

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)
Wilderness Areas	19,526	0	Old Forest	6,906	0
Designated Provincial Parks and Park Reserves	919	0	Operational Non Designated Parks and Reserves	2,698	0
Operational Non Designated Parks and Reserves	888	0	Designated Provincial Parks and Park Reserves	813	0
Peggy's Cove Preservation Area	797	0	Areas under the Special Places Act	370	0
Canadian Heritage Rivers	797	0	Ramsar Wetland Sites	317	0
Sites of Ecological Significance Under Moratorium	162	0	Eastern Habitat Joint Venture	0	0.1
Protected Beaches	74	54			

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 watercourse 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	1,090
Utility corridors	3	75
Gravel Roads and active railways	6	799
Paved streets and roads collectors	10	607
Highways	15	1

Table 2: Distribution of Road Index Classes

Road Index Value		Area of Ecodistrict Affected	
Indication	**Range**	**Hectares**	**Percent**
Remote	0 to 6	67,211	39.8
Forest Resource	7 to 15	40,233	23.8
Mixed Rural	16 to 24	29,278	17.3
AgricultureSuburban	25 to 39	31,648	18.7
Urban	40 to 100	555	0.3
Total		**168,925**	**100.0**

Table 3: Road Index Values for Each Landscape Element Type

Landscape Element	Area (ha)	Road Index
Valley Corridors	317	31
Coastal Spruce Ridges	16,837	8
Coastal Spruce	41,988	11
Coastal Barrens	55,342	7
Coastal Beach	557	15
Coastal Mixedwood Hills and Drumlins	12,111	15
Coastal Mixedwood Hills	26,450	11
Salt Marsh	228	34
Coastal Spruce Flats	672	10
Wetlands	4,768	11
Total	**109,572***	**6**

*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

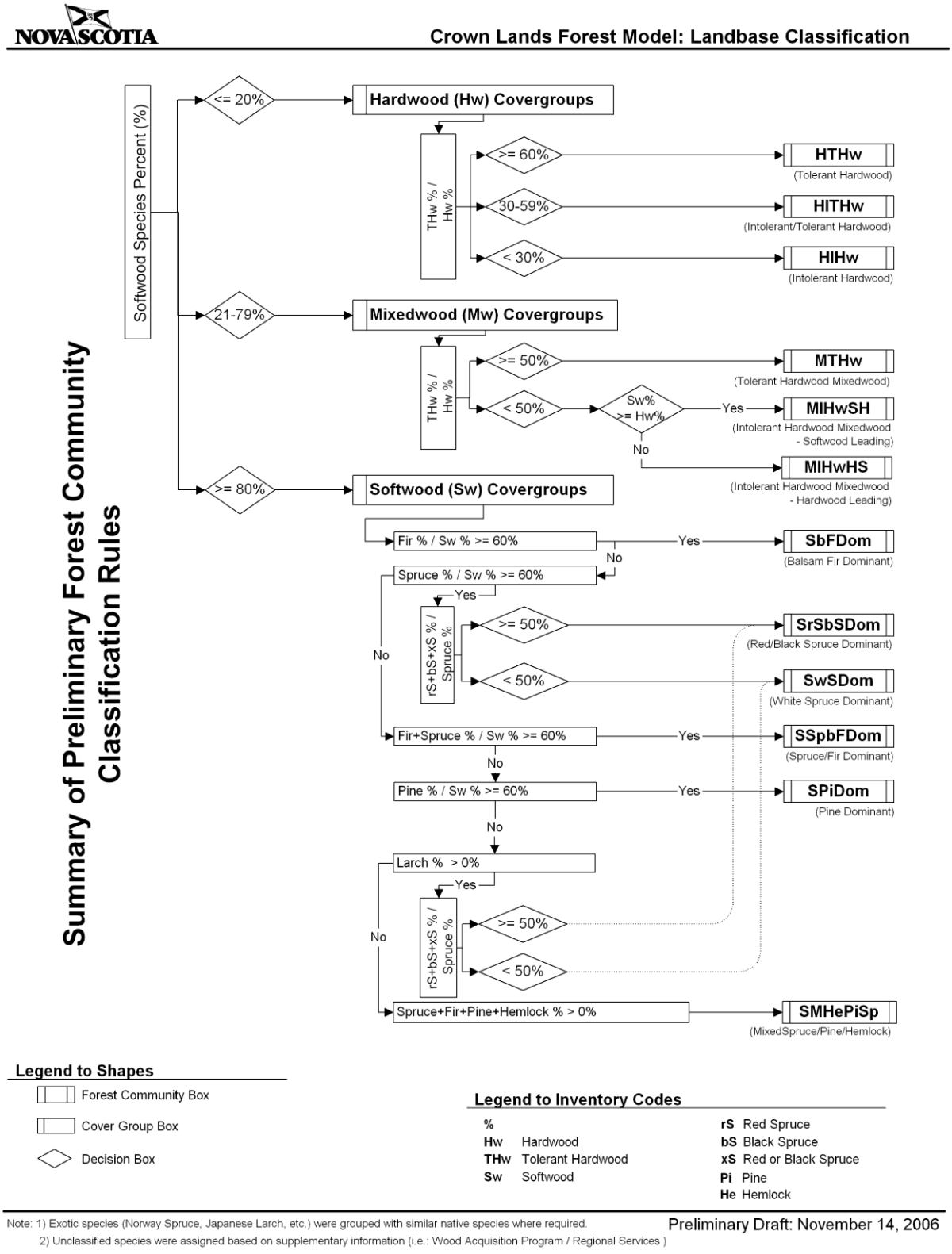
Development Class	Seral Stage
1. Forest Establishment (Height 0 to 6 m) • establishment of new growth following a stand-initiating disturbance • high diversity of forbs, shrubs, and tree regeneration, many of which are short-live shade-intolerant "pioneer" species • peak seed production by forbs and 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 > 11 m) • 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
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	100	210	220	310	320	330	340	350	360	370	380	410	420	430	440	450	510	520	530	540	550	560	610	620	630	710	720	730	740	750	760	770	780	810	820	830	840	910	920
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	3	2	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&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 1 to 5 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 - 23 early, 24 - 37 mid and 38 - 50 late.

Appendix 9: Vegetation Community Classification – Forest Model



Note: 1) Exotic species (Norway Spruce, Japanese Larch, etc.) were grouped with similar native species where required.
2) Unclassified species were assigned based on supplementary information (i.e.: Wood Acquisition Program / Regional Services)

Preliminary Draft: November 14, 2006

Appendix 10: Table 1: Forest Landscape Composition Worksheet (Eastern Shore 820)

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)				
Coastal Spruce	IMHO (83.0%) WMHO (12.0%) IMKK (2.0%) WFHO (2.0%) IFHO (1.0%)	Softwood	bS bS wS	Frequent	42,467; 100.0	Early	6	26	0	5	37	26,294; 87.8	EARLY	592; 2.0
						Mid	37	196	72	42	346			
						Late	2,093	10,106	6,726	4,952	23,878			
						Unclassified	2,032	0	0	0	2,032			
		Mixedwood				Early	30	14	13	0	56	1,702; 5.7	MID	1,425; 5.0
						Mid	187	246	367	130	931			
						Late	57	228	247	99	630			
						Unclassified	85	0	0	0	85			
		Hardwood				Early	89	85	102	25	302	457; 1.5	LATE	24,512; 82.0
						Mid	46	30	72	2	148			
						Late	0	0	3	0.0	3			
						Unclassified	4	0	0	0	4			
		Unclassified				Early	175	8	14	0	197	1,484; 5.0	UNCLASS	3,408; 11.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Unclassified	1,287	0	0	0	1,287			
Total					**42,467***	**(ha)**	**6,128**	**10,939**	**7,615**	**5,255**	**29,936**			
						%	**20.5%**	**36.5%**	**25.4%**	**17.6%**	**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 (Eastern Shore 820)

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)				
Coastal Spruce Ridges	IMRD (58.0%) WMRD (42.0%)	Softwood	bS wS	Frequent	17,533; 100.0	Early	0	23	0	7	30	10,365; 88.0	EARLY	170; 1.0
						Mid	2	87	7	49	145			
						Late	358	3,098	2,839	3,093	9,388			
						Uncl	802	0	0	0	802			
		Mixedwood				Early	0	12	0	0	12	647; 5.0	MID	593; 5.0
						Mid	67	173	68	71	378			
						Late	9	93	91	44	237			
						Uncl	20	0	0	0	20			
		Hardwood				Early	23	60	24	0	107	177; 2.0	LATE	9,625; 82.0
						Mid	7	40	23	0	70			
						Late	0	0	0	0.0	0			
						Uncl	0	0	0	0	0			
		Unclassified				Early	20	1	0	0	22	571; 5.0	UNCL	1,372; 12.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	549	0	0	0	549			
Total					**17,533***	**# ha**	**1,858**	**3,586**	**3,052**	**3,264**	**11,760**			
						%	**15.8%**	**30.5%**	**26.0%**	**27.8%**	**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 (Eastern Shore 820)

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)				
Coastal Barrens	WCKK (50.0%) WCHO (26.0%) ICHO (13.0%) WCRD (11.0%) ICKK (<1.0%)	Softwood	bS rM bS	Frequent	22,481; 40.0	Early	16	7	3	0	26	18,980; 75.0	EARLY	1,065; 4.0
						Mid	32	145	21	1	199			
						Late	2,117	10,616	2,546	3,039	18,318			
						Uncl	437	0	0	0	437			
		Mixedwood				Early	9	20	0	0	29	4,331; 17.0	MID	3,353; 13.0
						Mid	232	1,139	479	690	2,540			
						Late	93	988	295	356	1,732			
						Uncl	30	0	0	0	30			
		Hardwood				Early	173	468	183	133	957	1,579; 7.0	LATE	20,055; 80.0
						Mid	25	318	113	158	613			
						Late	0	0	5	0	5			
						Uncl	5	0	0	0	5			
		Unclassified				Early	40	9	6	0	55	322; 1.0	UNCL	740; 3.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	268	0	0	0	268			
Total					**56,203***	**# ha**	**3,476**	**13,711**	**3,649**	**4,376**	**25,212**			
						%	**13.8%**	**54.4%**	**14.5%**	**17.4%**	**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 (Eastern Shore 820)

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)				
Coastal Beach	XXCB	Softwood				Early	0	0	0	0	0	168; 94.0	EARLY	0; 0.0
						Mid	0	0	0	0	0			
						Late	28	84	21	24	156			
						Uncl	12	0	0	0	12			
		Mixedwood				Early	0	0	0	0	0	0; 0.0	MID	0; 0.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	0	0	0	0	0			
		Hardwood				Early	0	0	0	0	0	0; 0.0	LATE	156; 87.0
						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	10; 6.0	UNCL	23; 13.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	10	0	0	0	10			
Total					**656***	**# ha**	**50**	**84**	**21**	**24**	**179**			
						%	**28.1%**	**47.2%**	**11.5%**	**13.3%**	**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 (Eastern Shore 820)

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)				
Coastal Mixedwood Hills and Drumlins	WMDM (52.0%) WFDM (36.0%) WCDM (12.0%)	Softwood	bS wS	Frequent	1,051; 8.5	Early	8	7	0	0	15	6,984; 75.0	EARLY	332; 3.0
						Mid	8	21	20	6	55			
						Late	487	2,272	2,373	1,219	6,350			
						Uncl	564	0	0	0	564			
		Mixedwood				Early	0	0	0	0	0	1,389; 15.0	MID	1,104; 12.0
						Mid	108	243	334	163	847			
						Late	20	144	214	77	454			
						Uncl	87	0	0	0	87			
		Hardwood	rM yB	Frequent	11,270; 91.5	Early	32	79	94	74	278	481; 5.0	LATE	6,806; 73.0
						Mid	8	46	110	39	201			
						Late	0	0	2	0	2			
						Uncl	0	0	0	0	0			
		Unclassified				Early	19	7	13	0	39	490; 5.0	UNCL	1,102; 12.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	451	0	0	0	0			
Total					**12,321***	**# ha**	**1,791**	**2,817**	**3,159**	**1,577**	**8,892**			
						%	**20.1%**	**31.7%**	**35.5%**	**17.7%**	**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 (Eastern Shore 820)

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	WMKK (41.0%) ICHO (11.0%) WMRD (9.0%) WCKK (9.0%) IMHO (6.0%) WCHO (5.0%)	Softwood	bS wS bS bS,rM	Frequent	216; 67.0	Early	0	0	0	0	0	146; 75.0	EARLY	2; 1.0
						Mid	0	0	0	0	0			
						Late	0	61	47	36	145			
						Uncl	2	0	0	0	2			
		Mixedwood				Early	0	0	0	0	0	42; 21.0	MID	34; 18.0
						Mid	0	1	24	5	29			
						Late	0	3	9	1	13			
						Uncl	0	0	0	0	0			
		Hardwood				Early	1	0	1	0	2	8; 4.0	LATE	157 80.0
						Mid	0	0	6	0	6			
						Late	0	0	0	0	0			
						Uncl	0	0	0	0	0			
		Unclassified				Early	0	0	0	0	0	0; 0.0	UNCL	2; 1.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	0	0	0	0	0			
Total					**324***	**# ha**	**3**	**65**	**86**	**42**	**196**			
						%	**1.4%**	**33.0%**	**44.1%**	**21.5%**	**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 (Eastern Shore 820)

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)				
Coastal Mixedwood Hills	WMKK (100.0%)	Softwood	bS wS	Frequent	26,717; 100.0	Early	7	16	0	0	23	16,688; 75.0	EARLY	680; 3.0
						Mid	12	105	16	15	148			
						Late	753	5,370	5,160	2,699	13,982			
						Uncl	2,535	0	0	0	2,535			
		Mixedwood				Early	5	1	5	0	11	2,973; 13.0	MID	2,269; 10.0
						Mid	307	450	970	87	1,815			
						Late	48	322	488	124	981			
						Uncl	166	0	0	0	166			
		Hardwood				Early	136	123	273	0	981	848; 4.0	LATE	14,965; 68.0
						Mid	23	39	245	0	166			
						Late	0	2	0	0	532			
						Uncl	7	0	0	0	307			
		Unclassified				Early	83	11	21	0	2	1,653; 8.0	UNCL	4,247; 19.0
						Mid	0	0	0	0	7			
						Late	0	0	0	0	115			
						Uncl	1,539	0	0	0	7			
Total					**26,717***	**# ha**	**5,621**	**6,438**	**7,178**	**2,925**	**21,778**			
						%	**25.8%**	**29.6%**	**33.0%**	**13.4%**	**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 (Eastern Shore 820)

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	XXCB	Softwood				Early	0	0	0	0	0	90; 88.0	EARLY	0; 0.0
						Mid	0	0	0	3	3			
						Late	3	31	26	27	88			
						Uncl	0	0	0	0	0			
		Nil		Open Seral		Early	0	0	0	0	0	13; 12.0	MID	10; 10.0
						Mid	0	3	2	2	8			
						Late	0	0	5	0	5			
						Uncl	0	0	0	0	0			
		Hardwood				Early	0	0	0	0	5	0; 0.0	LATE	92; 90.0
						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	<1; <1.0	UNCL	<1; <1.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	0	0	0	0	0			
Total					**279***	**# ha**	**3**	**34**	**33**	**32**	**108**			
						%	**3.2%**	**32.0%**	**30.9%**	**29.4%**	**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 (Eastern Shore 820)

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)				
Coastal Spruce Flats	IMSM (100.0%)	Softwood	bS bF	Frequent	405; 60.0	Early	0	0	0	0	0	428; 94.0	EARLY	5; 1.0
						Mid	0	0	0	0	0			
						Late	25	320	37	20	401			
						Uncl	27	0	0	0	27			
		Mixedwood				Early	0	0	0	0	0	11; 2.0	MID	2; <1.0
						Mid	1	0	1	0	2			
						Late	6	2	0	0	8			
						Uncl	1	0	0	0	1			
		Hardwood				Early	3	2	0	0	0	5; 1.0	LATE	409; 90.0
						Mid	0	0	0	0	2			
						Late	0	0	0	0	8			
						Uncl	0	0	0	0	1			
		Unclassified				Early	0	0	0	0	5	11; 2.0	UNCL	39; 9.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	11	0	0	0	0			
Total					**674***	**# ha**	**73**	**325**	**37**	**20**	**455**			
						%	**16.1%**	**71.4%**	**8.2%**	**4.3%**	**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 (Eastern Shore 820)

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)				
Wetlands	WTLD (93.0%) PMHO (7.0%)	Softwood	bS bF bS	Open Seral	1,433; 30.0	Early	0	13	2	1	16	1,381; 89.0	EARLY	62; 4.0
						Mid	14	41	5	17	77			
						Late	74	564	246	315	1,198			
						Uncl	90	0	0	0	90			
		Mixedwood				Early	0	6	0	0	6	64; 4.0	MID	113; 7.0
						Mid	1	12	11	9	32			
						Late	0	12	6	3	20			
						Uncl	5	0	0	0	5			
		Hardwood				Early	7	18	2	0	6	30; 2.0	LATE	1,219; 78.0
						Mid	0	0	3	0	32			
						Late	0	0	0	0	20			
						Uncl	0	0	0	0	5			
		Unclassified				Early	13	1	0	0	27	78; 5.0	UNCL	161; 10.0
						Mid	0	0	0	0	3			
						Late	0	0	0	0	0			
						Uncl	65	0	0	0	3			
Total					**4,778***	**# ha**	**267**	**666**	**276**	**345**	**1,542**			
						%	**17.3%**	**43.2%**	**17.9%**	**22.4%**	**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 Eastern Shore Grouped by Landscape Elements)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Coastal Spruce	IMHO WMHO IMKK WFHO IFHO	Frequent	bS bS, wS	S	SrSbSDom	17,071	60.0%	L	**Well-drained** Early – Mid VT: bF, bS, wS, rM, wB Late VT: bF, bS, wS, rM, yB **Moist** Early – Late VT: bF, bS, rM **Poor** Early - Late VT: bF, bS, rM, tL **Dry** Early-Late VT: jP, bS, rM
				S	SbFDom	6,293	22.1%	M/L	
				S	SSpbFDom	2,550	9.0%	M/L	
				S	SwSDom	357	1.3%	L	
				S	SPiDom	12	<1.0%	L	
				S	SMHePiSp	11	<1.0%	L	
				M	MIHwSH	1,246	4.4%	E/M	
				M	MIHwHS	454	1.6%	E/M	
				M	MTHw	3	<1.0%	L	
				H	HIHw	439	1.5%	E	
				H	HITHw	15	0.1%	M	
				H	HTHw	3	<1.0%	L	
Total						**28,453**	**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 Eastern Shore Grouped by Landscape Elements)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Coastal Spruce Ridges	IMRD WMRD	Frequent	bS, wS	S	SrSbSDom	7,242	64.7%	L	**Well-drained** Early – Mid VT: bF, bS, wS, rM, wB Late VT: bF, bS, wS, rM, yB **Moist** Early – Late VT: bF, bS, rM **Poor** Early - Late VT: bF, bS, rM, tL **Dry** Early-Late VT: jP, bS, rM
				S	SbFDom	2,081	18.6%	M/L	
				S	SSpbFDom	922	8.2%	M/L	
				S	SwSDom	118	1.1%	L	
				S	SPiDom	2	0.0%	L	
				M	MIHwSH	468	4.2%	E/M	
				M	MIHwHS	179	1.6%	E/M	
				H	HIHw	131	1.2%		
				H	HITHw	47	0.4%	M	
Total						**11,189**	**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 Eastern Shore Grouped by Landscape Elements)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Coastal Barrens	WCKK WCHO ICHO WCRD ICKK	Frequent	bS rM bS	S	SrSbSDom	16,078	64.6%	L	**Well-drained** Early – Late VT: bS, rM **Moist** Early – Late VT: bS, rM **Poor** Early - Late VT: bS, rM, tL **Dry** Early-Late VT: jP, bS, rM
				S	SSpbFDom	1,263	5.1%	M/L	
				S	SbFDom	1,244	5.0%	M/L	
				S	SwSDom	362	1.5%	L	
				S	SPiDom	23	0.1%	L	
				S	SMHePiSp	10	0.0%	L	
				M	MIHwSH	3,082	12.4%	E/M	
				M	MIHwHS	1,247	5.0%	E/M	
				M	MTHw	2	0.0%	L	
				H	HIHw	1,562	6.3%	E	
				H	HITHw	12	0.0%	M	
				H	HTHw	5	0.0%	L	
Total						**24,890**	**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 Eastern Shore Grouped by Landscape Elements)

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	N/A		S	SrSbSDom	78	46.2%	L	**Dry** Early-Late VT: bS, wS
				S	SwSDom	35	20.8%	L	
				S	SbFDom	31	18.1%	M/L	
				S	SSpbFDom	25	14.9%	M/L	
Total						**168**	**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 Eastern Shore Grouped by Landscape Elements)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Coastal Mixedwood Hills and Drumlins	WMDM, WFDM, WCDM	Frequent	bF, wS rM, yB	S	SrSbSDom	3,603	40.7%	L	**Well-drained** Early – Mid VT: bF, bS, wS, rM, wB Late VT: bF, bS, wS, rM, yB **Moist** Early – Late VT: bF, bS, rM **Poor** Early - Late VT: bF, bS, rM, tL **Dry** Early-Late VT: jP, bS, rM
				S	SbFDom	2,266	25.6%	M/L	
				S	SSpbFDom	630	7.1%	M/L	
				S	SwSDom	469	5.3%	L	
				S	SMHePiSp	12	0.1%	L	
				S	SPiDom	5	0.1%	L	
				M	MIHwSH	923	10.4%	E/M	
				M	MIHwHS	466	5.3%	E/M	
				H	HIHw	440	5.0%	E	
				H	HITHw	41	0.5%	M	
Total						**8,853**	**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 Eastern Shore Grouped by Landscape Elements)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Coastal Mixedwood Hills	WMKK	Frequent	bS, wS	S	SrSbSDom	9,065	44.2%	L	**Well-drained** Early – Mid VT: bF, bS, wS, rM, wB Late VT: bF, bS, wS, rM, yB **Moist** Early – Late VT: bF, bS, rM **Poor** Early - Late VT: bF, bS, rM, tL **Dry** Early-Late VT: jP, bS, rM
				S	SbFDom	5,376	26.2%	M/L	
				S	SSpbFDom	1,907	9.3%	M/L	
				S	SwSDom	339	1.7%	L	
				S	SMHePiSp	1	0.0%	L	
				M	MIHwSH	2,067	10.1%	E/M	
				M	MIHwHS	904	4.4%	E/M	
				M	MTHw	3	0.0%	L	
				H	HIHw	829	4.0%	E	
				H	HITHw	17	0.1%	M	
				H	HTHw	2	0.0%	L	
Total						**20,508**	**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 Eastern Shore Grouped by Landscape Elements)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Valley Corridors	WMKK ICHO WMRD WCKK IMHO WCHO	Frequent	bS wS bS bS rM	S	SbFDom	85	43.6%	M/L	**Well-drained** Early – Mid VT: bF, bS, wS, rM, wB Late VT: bF, bS, wS, rM, yB **Moist** Early – Late VT: bF, bS, rM **Poor** Early - Late VT: bF, bS, rM, tL **Dry** Early-Late VT: jP, bS, rM
				S	SrSbSDom	48	24.7%	L	
				S	SSpbFDom	10	4.9%	M/L	
				S	SPiDom	2	0.8%	L	
				S	SwSDom	1	0.7%	L	
				M	MIHwSH	23	11.8%	E/M	
				M	MIHwHS	19	9.7%	E/M	
				H	HIHw	8	3.8%	E	
Total						**196**	**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 Eastern Shore Grouped by Landscape Elements)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Salt Marsh	XXMS			S	SrSbSDom	45	44.2%	L	**Poor** Early - Late VT: bF, bS, rM, tL
				S	SbFDom	34	33.1%	M/L	
				S	SSpbFDom	6	5.6%	M/L	
				S	SwSDom	5	4.7%	L	
				M	MIHwSH	7	7.2%	E/M	
				M	MIHwHS	5	5.2%	E/M	
Total						**103**	**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 Eastern Shore Grouped by Landscape Elements)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Coastal Spruce Flats	IMSM	Frequent	bS, bF	S	SrSbSDom	275	61.8%	L	**Moist** Early – Late VT: bF, bS, rM **Poor** Early - Late VT: bF, bS, rM, tL
				S	SbFDom	115	25.9%	M/L	
				S	SSpbFDom	39	8.7%	M/L	
				M	MIHwSH	9	2.0%	E/M	
				M	MIHwHS	2	0.5%	E/M	
				H	HIHw	5	1.1%	E	
Total						**443**	**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 Eastern Shore Grouped by Landscape Elements)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Wetlands	WTLD PMHO		bS, bF bS	S	SrSbSDom	1,060	71.8%	L	**Moist** Early – Late VT: bF, bS, rM **Poor** Early - Late VT: bF, bS, rM, tL
				S	SbFDom	215	14.5%	M/L	
				S	SSpbFDom	104	7.0%	M/L	
				S	SwSDom	4	0.3%	L	
				M	MIHwSH	57	3.9%	E/M	
				M	MIHwHS	7	0.5%	E/M	
				H	HIHw	30	2.0%	E	
Total						**1,475**	**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
bS wS	52,069	30.3%	64,953	13.9%
bS	47,255	27.5%	86,879	18.6%
rockland	33,766	19.7%	33,766	7.2%
rM yB	11,261	6.6%	32,800	7.0%
bS rM	11,256	6.6%	11,256	2.4%
bS bF	1,735	1.0%	1,735	0.4%
Total	**157,342**	**91.7%***	**231,388**	**49.5%****

*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
Coastal Barrens	56,187	18,128	34,034	459	2,824	743	43,954 to 44,325	78 to 79
Coastal Spruce	42,446	2,588	33,562	392	2,167	3,737	28,792 to 30,660	68 to 72
Coastal Mixedwood Hills	26,706	1,467	19,004	345	1,358	4,534	16,939 to 19,206	63 to 72
Coastal Spruce Ridges	17,522	1,917	13,384	156	678	1,386	12,341 to 13,034	70 to 74
Coastal Mixedwood Hills and Drumlins	12,313	1,078	7,796	506	1,829	1,105	7,327 to 7,880	60 to 64
Wetlands	4,774	640	3,870	5	81	178	3,589 to 3,678	75 to 77
Coastal Spruce Flats	674	123	507	0	5	39	513 to 532	76 to 79
Coastal Beach	656	158	403	38	35	23	475 to 486	72 to 74
Valley Corridors	263	88	125	2	46	2	183 to 184	70
Salt Marsh	279	21	215	5	38	0	183	66
Total	**161,820**	**26,207**	**112,900**	**1,907**	**9,060**	**11,746**	**114,296 to 120,169**	**71 to 74**

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	7,321	937	5,720	68	507	90	5,266 to 5,311	72 to 73
ICKK	149	29	92	1	27	0	98	66
IFHO	587	10	318	21	203	34	263 to 280	45 to 48
IMHO	35,315	1,780	28,669	263	1,461	3,143	24,133 to 25,704	68 to 73
IMKK	853	7	721	13	50	61	567 to 598	66 to 70
IMRD	10,106	950	7,581	110	469	996	6,912 to 7,411	68 to 73
IMSM	671	122	506	0	5	38	511 to 530	76 to 79
PMHO	322	1	276	1	45	0	208	64
WCDM	1,501	447	1,027	5	22	0	1,219	81
WCHO	14,518	3,571	9,682	115	835	315	10,940 to 11,098	75 to 76
WCKK	28,177	11,661	15,007	190	991	328	23,046 to 23,210	82
WCRD	6,111	1,931	3,576	88	506	10	4,637 to 4,643	76
WFDM	4,373	191	2,447	230	1,255	250	2,146 to 2,271	49 to 52
WFHO	677	15	451	35	168	9	364 to 368	54
WMDM	6,438	439	4,314	273	556	856	3,957 to 4,385	61 to 68
WMHO	5,071	787	3,448	58	285	493	3,511 to 3,757	69 to 74

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

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
WMKK	26,854	1,548	19,057	346	1,363	26,854	1,548	19,057
WMRD	7,457	967	5,841	46	210	7,457	967	5,841
WTLD	4,443	638	3,593	3	34	4,443	638	3,593
XXCB	654	158	401	38	34	654	158	401
XXMS	277	21	214	4	38	277	21	214
Total	**161,874**	**26,210**	**112,941**	**1,908**	**9,062**	**11,752**	**114,331 to 120,207**	**71 to 74**

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.