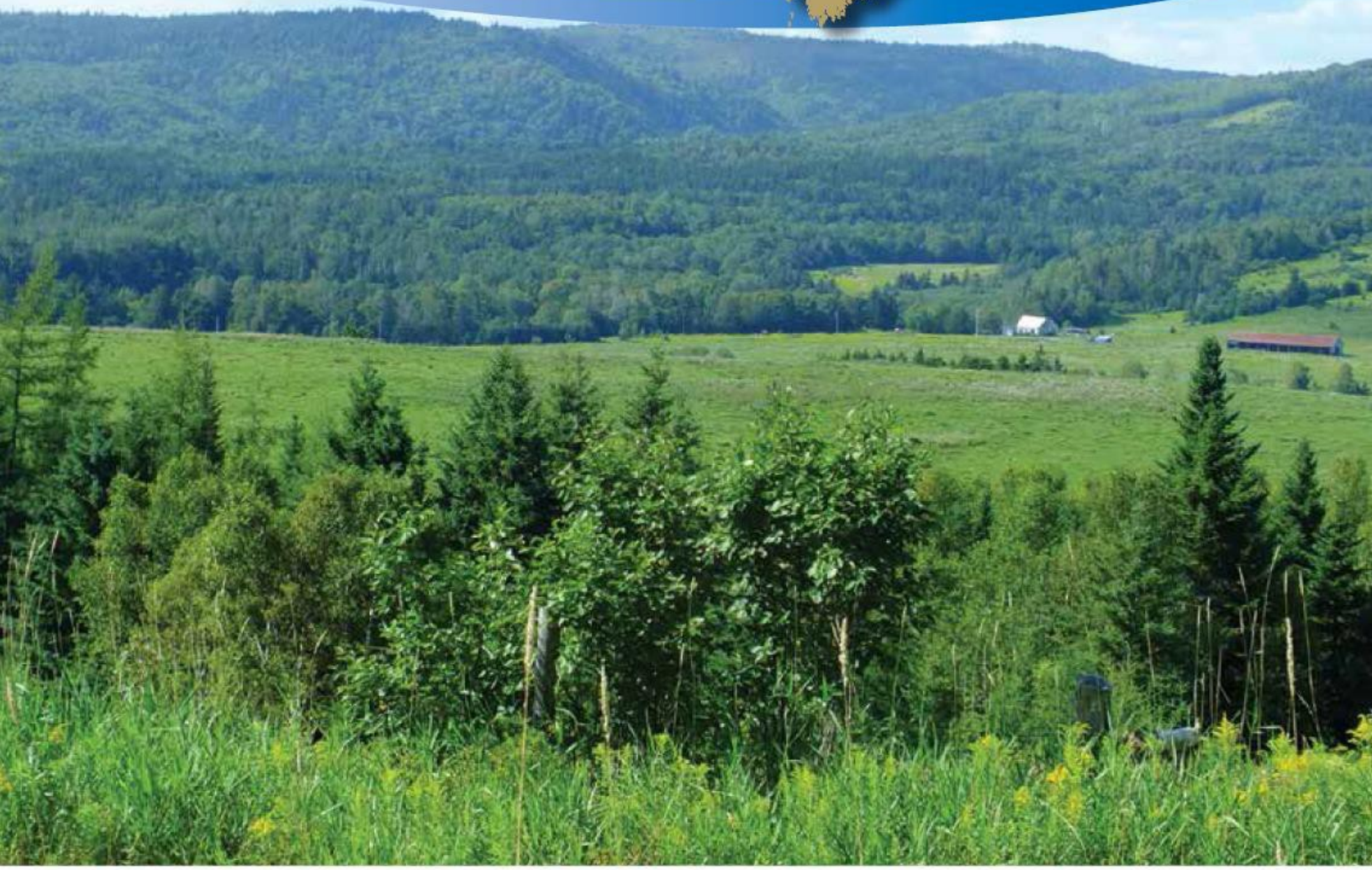
Department of Natural Resources

ECOLOGICAL LANDSCAPE ANALYSIS COBEQUID SLOPES ECODISTRICT 350

PART 3: Landscape Analysis for Forest Ecosystem Planners



ELA 2014-350

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 350: Cobequid Slopes

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This report, one of 38 for the province, provides descriptions, maps, analysis, photos and resources of the Cobequid Slopes 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.

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Part 3: Landscape Analysis of Cobequid Slopes – *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 Department of Natural Resources will continue to develop landscape planning approaches and introduce additional tools to support sustainable management and biodiversity conservation. The Department is working with stakeholders to explore novel planning approaches using these methods.

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

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Understanding the Landscape as an Ecological System

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

Landscapes are large areas that function as ecological systems and respond to a variety of influences. Landscapes are composed of smaller ecosystems, known as elements, which were interpreted through analysis using the ecosection layer of the Ecological Land Classification (ELC) for Nova Scotia. Elements are described by their potential vegetation (e.g. climax forest type) and physical features (e.g. soil, landform). These characteristics help determine historical vegetation patterns and promote an understanding of present distributions and potential habitat

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

Elements Within Landscapes (Map 2)

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

Tolerant Mixedwood Hills is the matrix element, representing 58% of the ecodistrict. This element naturally supports shade-tolerant species of the Acadian Forest, such as sugar maple, yellow birch, beech, and red spruce. In areas of stand-level disturbances, early successional species often become established, such as red maple, white and grey birch, aspen, and balsam fir.

Red Spruce Hummocks, representing 36% of the ecodistrict, is the largest patch element. The dominant species is red spruce. The two other patch elements, in order of size, are **Tolerant Mixedwood Slopes** and **Spruce Pine Hummocks**.

Valley Corridors, a linear element associated with the major watercourses in the ecodistrict, also includes floodplains.

The main corridor systems follow the major river valleys. These systems dissect the ecodistrict but also provide linkages to the Cobequid Hills and the Minas Lowlands ecodistricts.

The forests within some of these corridors, most notably along the Economy River, at the north end of the Great Village River and along the North River, 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, trout, eagles, beaver/fisher, and bats.

As an example of this flow – element interaction, deer move out of the upper reaches of the ecodistrict, from areas such as MacLellan Mountain, down to the lower elevations along the Minas Basin. These mature hardwoods and mixedwood areas have been altered by human intervention (forest harvesting, agriculture and human settlement) and have changed to establishment and young development classes of red maple, grey birch, aspen, balsam fir, and white spruce. One goal would be to reduce the early and mid seral species and favour or promote more late seral red and black spruce, hemlock, yellow birch, and sugar maple. Stand size should also be increased through

management strategies, such as pre-commercial and commercial thinning that would also increase the browse for moose and deer.

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.

River corridors promote connectivity.

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

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

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

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.

Cobequid Slopes is currently dominated by a somewhat changed structure that does not entirely represent the inherent natural conditions that once characterized this landscape. Human land use, transportation systems, and utility corridors have fragmented some of the element types, reducing

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.

An additional concern 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. At the landscape scale of planning, connectivity among these areas is supported by the dominant forest structure.

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

Connectivity issues and opportunities for Cobequid Slopes include:

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

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

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 Cobequid Slopes, Cobequid Hills, and Minas Lowlands ecodistricts.

Deer move out of the higher elevations in winter down through the ecodistrict and into their wintering areas along the Minas Basin. People provide many 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 (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 Cobequid Slopes

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Tolerant Mixedwood Hills	IH1, IH3, IH4, IH5, IH6, MW4, MW5	30.0	MW2, SH5, SH6, SH8	25.0	**MW1, MW3,** SH1	26.0
Tolerant Mixedwood Slopes	IH6, MW4, MW5	15.0	MW2, SH5, SH8	32.0	**MW1, MW3,** SH1	40.0
Red Spruce Hummocks	IH1, IH3, IH4, IH5, IH6, MW4, MW5	20.0	MW2, SH5, SH6, SH7, SH8	28.0	**SH3,** SH1, SH2, SH4	32.0
Spruce Pine Hummocks	SP8	65.0	SP4, SP6	17.0	**SP5,** SP7	0.0

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 Cobequid Slopes is 54 to 63 (Appendices 12a and 12b), which would suggest that overall intensity of land use is currently at a relatively changed state affecting both the structure and function to support habitat for all species and for biodiversity conservation.

About 57% of the lands fall within the extensive EEC. Unclassified lands account for 17% of the ecodistrict. The other classes, in order of size, are converted (12%), intensive (9%), and reserve (5%).

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, villages, and towns. Some locations, especially along the river corridors, show opportunity for restorative measures to the predicted climax stands of spruce, elm, sugar maple, and white ash.

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, Cobequid Slopes has an overall Road Index value of 10.6 (Appendix 7, Table 3). This average falls within the Forest Resource Index range of 7 to 15 and may be described as moderately low (Appendix 7, Table 2). Only 5.5% of the ecodistrict has a Remote Road Index of 0 to 6. Ninety-three percent of the ecodistrict has road indices in the Forest Resource, Mixed Rural, and Agriculture/Suburban categories.

As expected, the highest road densities occur around settlements and main transportation systems and fall in the Urban category at 1%.

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

- Conserving the relatively low road densities within the matrix (RI of 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.
- Improving the distribution and connectivity among the few low road density areas, especially near Little Bass River, Scrabble Hill, Barren Brook, and Staples Brook, helping to improve connectivity among natural areas and linkages to neighbouring ecodistricts.

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

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

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

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

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

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

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

Species at Risk

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

Species of Conservation Concern

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

are a priority in landscape planning because a focus on them now can prevent these species from becoming species at risk later.

Species Ranking and Coding Systems

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

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

A second system commonly used is NatureServe Conservation Data Centre system. This system uses numbers from 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 Cobequid Slopes Ecodistrict, there are documented occurrences (under the NSESA) of the following number of formally listed species: three endangered, two threatened, and two vulnerable. In addition to the listed species, the National General Status process also identifies eight orange-listed species, 17 yellow-listed species, 19 green-listed species, and five undetermined species for a total of 49 other species of conservation concern in this ecodistrict.

Designated species at risk found within the Cobequid Slopes Ecodistrict include Atlantic salmon, black ash, mainland moose, two species of bats (little brown myotis, northern long-eared myotis), and several bird species (olive-sided flycatcher, eastern wood-pewee, bobolink, wood thrush, and bank swallow).

Other species of conservation concern known for the Cobequid Slopes Ecodistrict include pine siskin and boreal chickadee (birds); marsh bellflower, and smooth sweet cicely (dicots); lance-leaf grape-fern and least moonwort (ferns and their allies); artic fritillary and banded hairstreak (insects); short-awned foxtail and porcupine sedge (monocots).

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).*

Birds

As of 2013, five species of birds found to be present in the ecodistrict are designated at risk. Three of these are listed under the NSESA: the olive-sided flycatcher as threatened; and the bobolink and eastern wood-pewee as vulnerable. Nationally, there is one species listed under SARA, the olive-sided flycatcher as threatened. COSEWIC has designated all five species: olive-sided flycatcher, bobolink, wood thrush, and bank swallow as threatened; and the eastern wood-pewee as special concern.

Generally there has been a nationwide decline in aerial insectivores, which are commonly attributed to a decline in flying insects. Most likely the population decline is influenced by multiple causes such as habitat loss, change across the landscape, and a decline in insects.

The olive-sided flycatcher prefers spruce and fir swamps and bogs with open water. This species has experienced long term declines attributed to habitat loss in wintering grounds, a decline in insects, and climate change.

Eastern wood-pewee can be found in deciduous forests typically along the edges and clearing with closed canopy and open understory conditions. This species has declined over the past few decades and almost exclusively feeds on flying insects. The decline in population is most likely attributed to a combination of loss of habitat in the wintering range, current forestry practices, and climate change.

The bobolink is associated with large open grasslands and hayfields. Declines are due to mortality from agricultural practices, habitat loss and fragmentation, and bird control methods.

The wood thrush prefers both mature deciduous or mixed forest habitats and feeds primarily on insects and fruit. Population declines both long and short-term are associated with habitat loss on its wintering grounds and habitat fragmentation on its breeding grounds.

The bank swallow has shown a decline over the past number of years. They nest in exposed bank faces that include river banks, hardened sawdust piles, coastal bluffs, and gravel pits. Declines are attributed to loss of nesting, breeding, and foraging habitat.

Dicots

Only one species at risk is documented for the Cobequid Slopes Ecodistrict: black ash. In 2013, black ash was listed under the NSESA as threatened; there are an estimated 1,000 individuals and only 12 mature trees in the province. In the Cobequid Slopes Ecodistrict, one site is documented on the Great Village River.

Fish

Historically, Atlantic salmon have utilized many of the river systems that are found in this ecodistrict, including Economy, Portapique, Great Village, Debert, Chiganois, and North rivers for spawning and continue to make some use of the available habitat they present.

The Inner Bay of Fundy salmon population has steadily declined over the last 20 years and has been designated as endangered by COSEWIC and protected under the federal Species at Risk Act.

The decline in Atlantic salmon is not well understood but evidence suggests that low marine survival is a primary cause which may be due to ecological changes in the Bay of Fundy. Other threats to this species include environmental contaminants, habitat loss and degradation, lack of riparian buffers along waterways, water passage obstruction, and lack of pools.

Mammals

Three species of mammals designated at risk occur in the Cobequid Slopes, including the mainland moose and two species of bats.

Moose on the mainland of Nova Scotia have been listed as endangered under the Nova Scotia Endangered Species Act (2003). Mainland moose are genetically distinct from those on Cape Breton Island, where moose populations are healthy.

The Cobequid Slopes Ecodistrict falls within a large area that has been identified as a significant concentration area for mainland moose. This area is considered to be "occupied moose habitat" (an area with recurrent observations of moose over time) and moose are reported to occur throughout in low numbers.

Moose are commonly associated with forested landscape habitats that have frequently been altered by a disturbance regime, such as fire, wind, disease, and timber harvesting. Historically in this ecodistrict, fire played an important role in beneficial habitat provisions for the moose population. Now, because of the modern approach to fire management, the role of fire as a natural disturbance is no longer providing conditions for moose habitat.

Timber harvesting practices, as well as other forms of land use, have an important role in creating a change in the forest landscape. This change is important in providing food for moose, such as the succulent twigs, stems, and foliage of young deciduous trees and shrubs.

The habitat requirements of moose are largely dependent on successional forest stages. Early succession hardwood trees and shrubs provide important browse while mature conifer cover is available for shelter, thermal cover and protection in winter and summer. Secluded wetland areas with emergent vegetation are used for both feeding and cooling during the summer. The availability of suitable habitat for endangered mainland moose is important in maintaining its future presence.

Special management practices for mainland moose are applied for forestry activities on Crown land in designated concentration areas
(see http://novascotia.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_Mainland_Moose.pdf) .

Application of these practices during forest management planning aim to conserve calving areas, maintain aquatic feeding areas, and provide thermal refugia. The Forest / Wildlife Guidelines and Standards provide minimal habitat specifications for moose on Crown land through the 8%

retention for old growth, maintenance of reasonable age class distribution, and maintenance of a 20 metre buffer zone along watercourses.

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

The population of both bat species 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 seven 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 is one documented hibernation site near the Cobequid Hills boundary.

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

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

Landscape elements were identified by combining ecosections with similar characteristics. Table 9 provides explanations of ecosections and their relationship to elements.

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

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

350 Cobequid Slopes Ecodistrict			
Landscape Element and Type	**Ecosections***	**Dominant Natural Disturbance Regime**	**Dominant Climax Type**
Tolerant Mixedwood Hills (Matrix)	IFKK WCKK WCHO WMKK WFKK	Infrequent	red Spruce (rS), yellow Birch (yB), sugar Maple (sM)
Red Spruce Hummocks (Patch)	IMHO WMHO IMRD	Infrequent	rS
Tolerant Mixedwood Slopes (Patch)	WCDS WMDS	Gap	rS, eastern Hemlock (eH), white Pine (wP), yB, sM
Spruce Pine Hummocks (Patch)	ICHO	Frequent	black Spruce (bS), wP
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

Four of the 12 ecosections (ICHO, IMSM, WCDS, and WFKK) each comprise less than 2% of the ecodistrict (Appendix 3, Table 2).

The black spruce-white pine within the ICHO ecosection has the highest land use pressures within the eocoregion with 46% converted to human settlement, farming, and other development activities. The forest communities within the WMKK, WFKK, and IMSM are also experiencing high conversions ranging from 20% to 44%. No ecosection is more than 70% converted.

Old growth stands have been identified on 1,819 hectares, or approximately 5% of the Crown lands under the Old Forest Policy.

Additional representation is required in a number of these community types. Opportunities are limited because of present level of Crown ownership and high conversion rates related to the area or ecosection.

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.
- 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 elm-sugar maple-ash stands along river corridors or jack pine-black spruce-white pine 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 2,741 hectares of Crown land has been set aside under legal and policy reserves within Cobequid Slopes (Appendix 5).

There are 1,819 hectares of old forest (nearly 50%, or 842 hectares, are in the wilderness areas) under the Old Forest Policy and in two wilderness areas – Economy River and Portapique River – which are only partially within this ecodistrict. There are also 922 hectares of legal reserves.

Additional lands near the Economy River Wilderness Area are of interest to the Colin Stewart Forest Forum. 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 uncommon or rare climax community type of black spruce and white pine in the ICHO ecosection, which comprises 0.1% of the ecodistrict and 4.5% of the ecoregion.

- Conservation of additional old forest area in the red spruce, black spruce, and elm-sugar maple-white ash community types.

ELA Summary

Element Interpretation (All appendices and maps)

The rolling topography of this ecodistrict is nestled between two fault lines. The Cobequid Fault provides the northern boundary, separating the older more resistant pre-Carboniferous rocks of the Cobequid Hills (340) from the late Carboniferous sandstone, shale, conglomerate, and coal of the Cobequid Slopes. As the topography levels into the Minas Lowlands (620) the Portapique Fault forms the southern boundary with softer Triassic era siltstone and sandstone.

As a narrow band of rolling hills from North River in the east to Economy in the west, the southerly aspect of this ecodistrict provides significant winter habitat for large populations of deer that come down from the higher elevations as snow accumulations restrict movement. Wetlands and lakes are nearly absent in this ecodistrict with most of the freshwater, 0.4% of the area, located in the streams and rivers that flow through the ecodistrict on their way to the Minas Basin.

This ecodistrict has an array of soils ranging from the very coarse sandy loams associated with glacial outwash (sediment deposited by meltwater streams in front of a glacier) to clay loams. The forests predominantly comprise shade-tolerant species with pure and mixed stands of red spruce, sugar maple, yellow birch, beech, and hemlock.

On the ecosections with gentler slopes or fairly level terrain, pure stands of red spruce or red spruce-yellow birch occur. For the most part, white pine is absent from the ecodistrict. Hemlock occurs on the steeper slopes along streams and rivers.

This ecodistrict is wedged between the uplands of the Cobequid Mountains and the lowlands of the Minas Basin and as such there are representative forests of both in this ecodistrict. For example, pure stands of tolerant hardwoods, usually with a higher beech component, are found on the hills of well-drained coarse soils between Pleasant Hills and Upper Bass River.

The hardwood forests have also experienced significant mortality with individual species succumbing to pathogens.

Tolerant Mixedwood Hills
(Matrix) (IFKK, WCKK, WCHO, WMKK and WFKK ecosections) (21,250 ha)

This is a mixedwood matrix element that comprises 58% of the ecodistrict. The inherent community of red spruce, sugar maple, yellow birch, and beech had undergone a change that is more towards early and mid seral species of grey and white birch, red maple, white spruce, balsam fir along with red-black spruce, sugar maple, and yellow birch (Appendix 10).

Harvesting has increased over the past few years as indicated by the amount of forest in the establishment development class at 30%. Approximately 5% is reserved as wilderness areas and

old growth at Economy, Londonderry, and Staples Brook. The EEI is 52 to 61 (Appendix 12a).

Flows

People (forestry, exploration, hunting, ATV, snowmobiles, utility corridors, hiking, Christmas trees, sugar bush); deer (general percolation of the population between the Cobequids and the Northumberland Lowlands); trout (habitat, feeder streams); beaver/fisher (habitat in feeder streams); bats (habitat, abandoned mine openings).

Composition

Cobequid Slopes Ecodistrict 350 (based on statistics up to 2006)
Composition of Tolerant Mixedwood Hills

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	30%	10%	60% (51 Mat + 9 OF)	9%
Seral Stage	Early	Mid	Late	Unclassified
	30%	25%	26%	19%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	47%	19%	29%	5%

Desired Condition

A mixedwood community type of red spruce, sugar maple, yellow birch, and scattered hemlock and white pine. At least 60% of the forest would be in the mature class with mid and late seral stages dominating.

Issues

- Approximately 55% or 9943 hectares of the forest are in the early and mid seral stages (Appendix 10).
- Thirty percent of the forest is found in the establishment development class.
- Almost 50% of the forest has a softwood covertype.
- Conversion to non-forest, such as blueberry fields, is fairly high (Appendix 12a).
- Matrix element has a mixture of legal and policy reserves and a total of 5% of provincial Crown lands has been set aside for reserves. Additional representation in the community of red spruce, hemlock, sugar maple, yellow birch, and beech is needed but there is only minor amount of Crown lands that have this representation.

Red Spruce Hummocks

(Patch) (IMHO, WMHO and IMRD ecosections) (13,371 ha)

This red spruce patch element comprises five areas, the largest and most noticeable in the Economy River and Montrose areas and extending from Great Village River to Central North River (Map 2).

This patch element is still predominately softwood (63%) but balsam fir and white spruce comprise half of this covertype. Intolerant hardwood mixedwoods comprise another 16%. The development classes are slightly unbalanced, with 33% of the forest in the establishment class (Appendix 10). The early and mid seral species dominate at 48%. Late seral species of sugar maple, yellow birch, and red-black spruce comprise 32% of the forested area.

The extensive forest class comprises 57%, of the area with reserves adding an additional 5%, giving this element an EEI of 59 to 68, the second highest in the ecodistrict (Appendices 12a and 12b).

Flows

People (forestry, exploration, hunting, ATV, snowmobiles, utility corridors, hiking, Christmas trees, sugar bush, agriculture); deer (refugia); trout (habitat); beaver/fisher (habitat); bats (habitat).

Composition

Cobequid Slopes Ecodistrict 350 (based on statistics up to 2006)
Composition of Red Spruce Hummocks

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	33%	16%	51% (43 Mat + 8 OF)	8%
Seral Stage	Early	Mid	Late	Unclassified
	20%	28%	32%	20%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	63%	10%	22%	5%

Desired Condition

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

Issues

- High percentage of the forest is in the early and mid seral class (48%).
- Thirty-two percent of the forest is within the establishment development class.
- Twenty percent of the forest has an unclassified seral stage.
- Eight percent of the forest has been converted to other uses.
- There are no legal reserves within this element.

Tolerant Mixedwood Slopes

(Patch) (WMDS and WCDS ecosections) (1,195 ha)

This is a somewhat fragmented patch type that occurs throughout the ecodistrict following some of the rivers and major tributaries (Map 2). The larger areas are found along the Economy River, Carrs Brook, Folly River, and the Chiganois River.

Currently, Tolerant Mixedwood Slopes is only 32% mixedwood, 54% softwood, and 12% hardwood. Unclassified lands account for 2% (Appendix 10).

This patch type has a gap disturbance regime with wind, ice storms, and damage associated with freeze/thaw cycles as the main disturbance agents. Fifty-nine percent of the forest is in the mature and multi-aged development class.

This element type has the highest EEI (Appendix 12a), attributed to a large percentage (77%) of the forest in the extensive class and also a low conversion (1%) for this patch type. Only 2% is in the reserve class.

Flows

People (forestry, exploration); deer (habitat, cover, food); trout (habitat); beaver/fisher (habitat); bats (abandoned mine openings).

Composition

Cobequid Slopes Ecodistrict 350 (based on statistics up to 2006)
Composition of Tolerant Mixedwood Slopes

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	26%	15%	59% (50 Mat + 9 OF)	9%
Seral Stage	Early	Mid	Late	Unclassified
	15%	32%	40%	13%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	54%	12%	32%	2%

Desired Condition

A mixedwood community of red spruce, eastern hemlock, white pine, sugar maple, yellow birch, and beech, with at least 70% of the forest community in the mature development class.

Issues

- Covertype has changes from mixedwood to softwood.
- Distribution of forest area by development class is skewed to the establishment and young classes.
- High percentage of seral stage and development class of forest lands unclassified.

- Seventeen percent conversion has occurred within the WCDS ecosection.
- Only 2% of this element provides representation for the community type of red spruce, hemlock, white pine, yellow birch, sugar maple, and beech. The Crown has set aside 21% of its holdings under the Old Forest Policy within the ecodistrict, but representation within this specific community type needs to be reviewed.

Spruce Pine Hummocks
(Patch) (ICHO ecosection) (54 ha)

This small patch element is inherently an imperfectly drained course-textured sandy loam knoll of black spruce and white pine that now is shifting to a softwood-dominated mixedwood with intolerant hardwoods of grey birch, white birch, and red maple. Only 8% of the present forest is in each of the softwood and hardwood covertypes (Appendix 10). This element has a frequent disturbance regime with wind as the main disturbance agent.

Sixty-five percent of the forest is in the early seral stages and 75% is in the mature development class. Less than 1% of the present forest is in the late seral stage. The ecosection in this element represents 0.1% of the ecodistrict and nearly half has been converted to other uses (Appendix 12b). There is no area under the legal or policy reserve status.

The EEI of this tiny patch element is the lowest of all elements within this ecodistrict with a range of 30 to 31 (Appendix 12a).

Flows

People (aggregate, agriculture, transportation corridor); eagles (perching, habitat).

Composition

Cobequid Slopes Ecodistrict 350 (based on statistics up to 2006)
Composition of Spruce Pine Hummocks

Development Class	Establishment	Young Competing	Mature (incl. multi-aged and old forest)	Multi-aged and Old Forest
	18%	7%	75% (75 Mat + 0 OF)	0%
Seral Stage	Early	Mid	Late	Unclassified
	65%	17%	0%	18%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	8%	8%	66%	18%

Desired Condition

Spruce and pine-dominated softwood stands in a variety of development stages consistent with the disturbance regime. There should be at least 40% of the forest area in the mature development class.

Issues

- A shift of the forest covertype from softwood-dominated to mixedwood.
- Sixty-five percent of the forest is in the early seral stage.
- Forty-six percent of the forest has been converted to other uses.
- Lack of provincial Crown representation and ownership.
- There is no representation of the black spruce, white pine community type in either legal or policy reserves.
- The Crown land productive forest for the ICHO ecosection is only eight hectares.

Valley Corridors

(Patch) (Various ecosections) (908 ha)

This corridor element comprises numerous river corridors that dissect the slopes in several locations. The main corridors include the Economy, Bass, Portapique, Great Village, Folly, Debert, Chiganois, and North rivers that flow to the Minas Basin.

The inherent climax communities were generally a mixedwood and hardwood covertype of red spruce, sugar maple, yellow birch, hemlock, white pine, and beech, along with elm, sugar maple, and white ash. The current forest is 58% softwood, 28% mixedwood, and 12% hardwood. The early and mid seral stages dominate, representing with 34% and 29% of the forest respectively. The development classes are fairly well-balanced for the disturbance regimes.

The forest along a number of these river systems has been altered by concentrated human activity that has created agriculture fields, settlement, intersecting roads, and other linear features.
Twenty-one percent of the element has been converted to other uses. The EEI is 45 to 48.

Flows

People (hiking along Economy and Chiganois rivers, smelt fishing in Lower Portapique, exploration); deer (travel, food, water, cover); trout (habitat); eagles (nesting, food from Economy and North rivers); beaver/fisher (habitat); bats (habitat, foraging along water courses).

Composition

Cobequid Slopes Ecodistrict 350 (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
	19%	8%	73% (62 Mat + 11 OF)	11%
Seral Stage	Early	Mid	Late	Unclassified
	33%	29%	23%	15%
Covertype	Softwood	Hardwood	Mixedwood	Unclassified
	58%	12%	28%	2%

Desired Condition

A series of well-connected slopes and intervales in a natural forest condition.

Issues

- Twenty-one percent of the forests within these corridors have been converted to other uses.
- Sixty-two percent of the forest is now in the early and mid seral stages.
- Covertype change from a mixedwood and hardwood to predominately softwood and mixedwood with less than 12% hardwood.
- Although only 13 hectares, or 1%, of this element is represented in the reserve class, these community types have additional representation within the matrix and patch elements.

Ecosystem Issues and Opportunities (All appendices and maps)

Management of the forest resource in the Cobequid Slopes 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:

- Location of ecodistrict in a relatively rural area that is heavily forested with a moderate to high intensity of land use as indicated by the EEI of 54 to 63.
- High percentage of the forest in most of the elements is in the early and mid seral stages.
- Representation is only 5 to 6% of the total ecodistrict. Additional old growth area is required in some of the climax community types, but there are limited Crown lands within this ecodistrict that provide this representation.
- Fairly high percentage of forest is in the unclassified category (13% to 20%).
- Tolerant Mixedwood Hills, which was once totally a mixedwood covertype, is now 47% softwood.
- Additional Crown lands are of interest as wilderness areas under Colin Stewart Forest Forum.

Appendix 1: Flow - Element Interactions

Element	People	Deer	Trout	Eagles	Beaver / Fisher	Bats
Matrix Tolerant Mixedwood Hills	Forestry, Exploration, Hunting, ATV snowmobiles, Utility Corridors, hiking, Christmas trees, and sugar bush	Percolation between Cobequids and the Northumberland Lowlands	Habitat - feeder streams	———	Habitat in feeder streams	Habitat - Abandoned Mine openings
Patches Red Spruce Hummocks	Forestry, Exploration, Hunting, ATV snowmobiles, Utility Corridors, hiking, Christmas trees and sugar bush, agriculture	Refugia - deer	Habitat	———	Habitat	Habitat
Tolerant Mixedwood Slopes	Forestry, Exploration	habitat, cover, food	Habitat	———	Habitat	Abandoned mine openings
Spruce Pine Hummocks	Aggregate, agriculture, transportation corridor	———		Perching, habitat	———	———
Corridor Valley Corridors	Hiking (Economy and Chiganois Rivers), smelts (Lower Portapique), Exploration	travel, food, water, cover	Habitat	Nesting, Food, etc. (Economy and North rivers)	Habitat	Foraging along watercourses

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
Tolerant Mixedwood Hills	Matrix	High	Londonderry Mining District - Cobequid Fault - Deer Refuge	Landscape	Infrequent	rS, yB, sM, Be	Red Spruce Hummocks rS, bS	Trans Canada (#104) - Level of harvesting - Cobequid Fault to east-west movement	Lack of late seral due to past and present harvesting - Conversion	manage by NDR and ELC guidelines - favour long-lived climax species in silvicultural treatments - apply retention cuts where applicable
Red Spruce Hummocks	Patch	High	Fault Zone - Debert Coal - DND - (Staples Brook)	Large and small patch types across the landscape	Infrequent	rS, bS	Tolerant Mixedwood Hills - rS, yB, sM, Be	Trans Canada (#104) - Cobequid Fault to east-west movement	Conversion - Harvesting	manage by NDR and ELC guidelines - reduce the unclassified area - increase late seral stages by silvicultural techniques
Tolerant Mixedwood Slopes	Patch	Moderate to High	Economy River	small scattered and fragmented patches	Infrequent / Gap	eH, wP, rS, sM, yB, Be	rS, yB	size of patches - Cobequid Fault	Development classes skewed to establishment and young. -Economy Falls Trail	NDR - Support efforts for tourism, trails - efforts to improve the mixedwood covertype and late seral species - reduce the unclassified forest

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
Spruce Pine Hummocks	Patch	Low to Moderate	Saints Rest	Localized - very small single patch	frequent	bS, wP	Red Spruce Hummocks rS, bS	patch size	66% of forest in early seral - high conversion - low EEI	- manage for late seral species - reduce conversion
Valley Corridors	Corridor	Moderate to High	rivers: Economy, Bass, Portapique, Great Village, Folly, Debert, Chiganois, North	Long continuous rivers dissecting the slopes that flow to the Minas Basin	infrequent / gap	all	all	settlement / development	non-continuous forest cover - settlement/ agriculture/ forestry	improve continuity

Appendix 2b: Connective Management Strategies

Structure Type	Attributes	Conditions of Concern	Management Strategies
Matrix	percolation, large patch, interior habitat	fragmentation, excessive edge	1. Promote contiguous forest structure using strategies such as patch aggregation and overstory-sustaining selection cutting 2. Promote large patch structure and interior conditions 3. Mitigate large-scale, long-term, fragmentation of the matrix that could impede percolation 4. Manage age and structure appropriate to NDR. For gap and infrequently disturbed ecosections maintain 60% mature cover
Patch Ecosystems	patch size, nearest neighbour, edge / interior, intervening habitat condition	undesirable connections, internal composition, excessive separations, threats to key patch	1. Identify and map 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 350)

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

SPECIES		DESIGNATION		
Common Name	**Scientific Name**	**Provincial**	**Federal**	**COSEWIC**
BIRDS	-			
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Threatened	Threatened
Eastern Wood-Pewee	*Contopus virens*	Vulnerable	N/A	Special Concern
Bobolink	*Dolichonyx oryzivorus*	Vulnerable	N/A	Threatened
Wood Thrush	*Hylocichla mustelina*	N/A	N/A	Threatened
Bank Swallow	*Riparia riparia*	N/A	N/A	Threatened
DICOTS	-			
Black Ash	*Fraxinus nigra*	Threatened	N/A	N/A
FISH	-			
Atlantic Salmon - Inner Bay of Fundy population	*Salmo salar pop. 1*	N/A	Endangered	Endangered
MAMMALS	-			
Little Brown Myotis	*Myotis lucifugus*	Endangered	N/A	Endangered
Northern Long-eared Myotis	*Myotis septentrionalis*	Endangered	N/A	Endangered
Moose (Mainland Population)	*Alces alces americana*	Endangered	N/A	N/A

Appendix 3: Special Occurrences (Ecodistrict 350)

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	-		
Boreal Owl	*Aegolius funereus*	Undetermined	S1B
Pine Siskin	*Carduelis pinus*	Sensitive (Yellow)	S3S4B,S5N
Gray Jay	*Perisoreus canadensis*	Sensitive (Yellow)	S3S4
Boreal Chickadee	*Poecile hudsonica*	Sensitive (Yellow)	S3
Philadelphia Vireo	*Vireo philadelphicus*	Undetermined	S2?B
DICOTS			
Drummond's Rockcress	*Arabis drummondii*	Sensitive (Yellow)	S2
Marsh Bellflower	*Campanula aparinoides*	Sensitive (Yellow)	S3
Hyssop-leaved Fleabane	*Erigeron hyssopifolius*	Sensitive (Yellow)	S3
Northern Bedstraw	*Galium boreale*	May Be At Risk (Orange)	S2
Smooth Sweet Cicely	*Osmorhiza longistylis*	May Be At Risk (Orange)	S2
Pink Pyrola	*Pyrola asarifolia*	Secure (Green)	S3
Bloodroot	*Sanguinaria canadensis*	Secure (Green)	S3S4
Long-leaved Starwort	*Stellaria longifolia*	Sensitive (Yellow)	S3
Roland's Sea-Blite	*Suaeda rolandii*	May Be At Risk (Orange)	S1?
Northern Bog Violet	*Viola nephrophylla*	Sensitive (Yellow)	S2
FERNS AND THEIR ALLIES			
Cut-leaved Moonwort	*Botrychium dissectum*	Secure (Green)	S3
Lance-Leaf Grape-Fern	*Botrychium lanceolatum var. angustisegmentum*	Sensitive (Yellow)	S2S3
Least Moonwort	*Botrychium simplex*	Sensitive (Yellow)	S2S3
Steller's Rockbrake	*Cryptogramma stelleri*	May Be At Risk (Orange)	S1
Bulblet Bladder Fern	*Cystopteris bulbifera*	Secure (Green)	S3S4
Meadow Horsetail	*Equisetum pratense*	Sensitive (Yellow)	S2
Dwarf Scouring-Rush	*Equisetum scirpoides*	Secure (Green)	S3S4
Variegated Horsetail	*Equisetum variegatum*	Secure (Green)	S3
Appalachian Polypody	*Polypodium appalachianum*	Undetermined	S3?
Smooth Cliff Fern	*Woodsia glabella*	Sensitive (Yellow)	S2
INSECTS			
Arctic Fritillary	*Boloria chariclea*	Sensitive (Yellow)	S2

Appendix 3: Special Occurrences (Ecodistrict 350)

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***
Juvenal's Duskywing	*Erynnis juvenalis*	Secure (Green)	S2S3
Baltimore Checkerspot	*Euphydryas phaeton*	Secure (Green)	S3
Common Branded Skipper	*Hesperia comma*	Secure (Green)	S3
Riffle Snaketail	*Ophiogomphus carolus*	Secure (Green)	S3
Green Comma	*Polygonia faunus*	Secure (Green)	S3
Question Mark	*Polygonia interrogationis*	Secure (Green)	S3B
Grey Comma	*Polygonia progne*	Secure (Green)	S3S4
Banded Hairstreak	*Satyrium calanus*	Undetermined	S2
Aphrodite Fritillary	*Speyeria aphrodite*	Secure (Green)	S3S4
MAMMALS			
Cougar - Eastern population	*Puma concolor pop. 1*	Undetermined	SH
MONOCOTS			
Short-awned Foxtail	*Alopecurus aequalis*	Sensitive (Yellow)	S2S3
Pubescent Sedge	*Carex hirtifolia*	Sensitive (Yellow)	S2S3
Porcupine Sedge	*Carex hystericina*	May Be At Risk (Orange)	S2
Plantain-Leaved Sedge	*Carex plantaginea*	May Be At Risk (Orange)	S1
Rosy Sedge	*Carex rosea*	Secure (Green)	S3
Long-bracted Frog Orchid	*Coeloglossum viride var. virescens*	May Be At Risk (Orange)	S2S3
Early Coralroot	*Corallorhiza trifida*	Secure (Green)	S3
Nodding Fescue	*Festuca subverticillata*	May Be At Risk (Orange)	S1
Canada Lily	*Lilium canadense Luzula*	Sensitive (Yellow)	S2S3
Small-flowered Woodrush	*parviflora Platanthera*	Secure (Green)	S3S4
Large Purple Fringed Orchid	*grandiflora*	Secure (Green)	S3
Large Round-Leaved Orchid	*Platanthera macrophylla*	Sensitive (Yellow)	S2
Narrow False Oats	*Trisetum spicatum*	Secure (Green)	S3S4

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

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

Appendix 3: Special Occurrences (Ecodistrict 350)
Table 1c – Other Conservation Features

Feature	Type	Information Source	Legislation or Status Ranking System
Deer Wintering Area	Habitat	NS Significant Species and Habitat Database	
Eagle Nests	Habitat	NS Significant Species and Habitat Database	NS Wildlife Act NS Environment Act NS Forests Act
Osprey Nests	Habitat	NS Significant Species and Habitat Database	NS Wildlife Act NS Environment Act NS Forests Act
Economy Falls	Feature	Local	
Hemlock Stand (Old)	Ecosystem	Local	NS Forests Act
Ironwood	Species	Local	NS Forests Act
Manganese Mines Wildlife Management Area	Ecosystem	Provincial Database	NS Wildlife Act NS
Barite	Feature	Local	
Cobequid Fault	Feature	NS Geological Database	
Debert (coal)	Feature	NS Mineral Occurrences	
Shale Pits		Local	
Gittens Lodge	Community	Local	
Sugar Maple Stand (Old)	Species	Local	NS Forests Act
Abandoned Mine Workings-Londonderry	Habitat	NS Significant Species and Habitat Database	NS Endangered Species Act
Londonderry Provincial Park	Park	Provincial Database	NS Parks Act

Appendix 3: Special Occurrences (Ecodistrict 350)
Table 1d – Heritage Features

Feature	Type	Information Source
Pole Railway	Heritage	Local
Portapique River Dam	Heritage	Local
Uranium Drill Sites	Heritage	Provincial Database
Slag Pile	Heritage	Local

Appendix 3: Special Occurrences

Table 2: Comparison of Ecological Emphasis Classification Index by Ecosection (Within Ecodistrict and Ecoregion) Ecosections that form 2% or less of the ecodistrict and/or ecoregion area, or are more than 75% converted are highlighted. The table provides a sense of how unique or uncommon an ecosection and its associated climax communities are within the ecodistrict and across the ecoregion. The EEC Index value conveys an indication of relative land use pressure on the ecosection.

Ecosection	Climax Type	Ecodistrict Occurrence						Ecoregion Occurrence					
		Area of Ecosection		Area of Climax Type (1, 2, 3) *		EEC Index ecosection	% Converted	Area of Ecosection		Area of Climax Type (1, 2, 3) *		EEC Index ecosection	% Converted
		Ha	%	Ha	%			Ha	%	Ha	%		
ICHO	bS wP	54	0.1	54	0.1	29 to 33	45.9	34,388	3.5	43,237	4.5	59 to 70	3.8
IFKK	rS sM yB Be	9,431	25.4	21,517	58.0	44 to 55	17.0	33,587	3.5	38,966	4.0	51 to 61	12.1
IMHO	rS	6,865	18.5	12,631	34.1	64 to 73	4.3	121,355	12.5	98,853	10.2	61 to 70	3.4
IMRD	rS	2,135	5.8	12,631	34.1	56 to 65	8.1	3,119	0.3	98,853	10.2	54 to 65	5.8
IMSM	aE sM wA	555	1.5	500	1.3	37 to 41	32.1	9,514	1.0	11,097	1.1	52 to 57	17.6
WCDS	rS eH wP sM yB Be	416	1.1	1,330	3.6	69 to 71	4.1	20,864	2.1	6,220	0.6	67 to 71	3.8
WCHO	rS sM yB Be	1,395	3.8	21,517	58.0	51 to 59	14.8	69,561	7.2	38,966	4.0	59 to 66	8.6
WCKK	rS sM yB Be	7,018	18.9	21,517	58.0	66 to 73	3.5	184,987	19.1	38,966	4.0	56 to 66	7.7
WFKK	rS sM yB Be	427	1.2	21,517	58.0	30 to 34	43.9	75,802	7.8	38,966	4.0	51 to 59	12.3
WMDS	rS eH wP sM yB Be	914	2.5	1,330	3.6	63 to 71	1.0	51,684	5.3	6,220	0.6	64 to 68	4.0
WMHO	rS	4,486	12.1	12,631	34.1	51 to 61	13.7	81,377	8.4	98,853	10.2	56 to 66	5.4
WMKK	rS sM yB Be	3,246	8.8	21,517	58.0	47 to 56	20.3	167,845	17.3	38,966	4.0	59 to 66	6.5

*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)
IFKK	rS sM yB Be	9,431	0.1	0	0	0	0	0	0.0	0	0.0	0	0.0
WCKK	rS sM yB Be	7,018	0.4	899	0	49	0	948	0.1	0	0.0	948	0.1
IMHO	rS	6,865	0.5	0	0	945	0	947	0.1	0	0.0	947	0.1
WMHO	rS	4,486	0.1	0	0	0	0	0	0.0	0	0.0	0	0.0
WMKK	rS sM yB Be	3,246	0.0	0	0	0	0	0	0.0	0	0.0	0	0.0
IMRD	rS	2,135	0.0	0	0	0.1	0	0.1	0.0	0	0.0	0.1	0.0
WCHO	rS sM yB Be	1,395	0.3	22	0	30	0	52	0.0	0	0.0	52	0.0
WMDS	rS eH wP sM yB Be	914	0.2	1	0	0	0	1	0.0	0	0.0	1	0.0
IMSM	aE sM wA	555	0.1	0	0	0	0	0	0.0	0	0.0	0	0.0
WFKK	rS sM yB Be	427	0.1	0	0	0	0	0	0.0	0	0.0	0	0.0
WCDS	rS eH wP sM yB Be	416	0.5	0	0	27	0	27	0.1	0	0.0	27	0.1
XXWA	NONE	145	0.0	0	0	0	0	0	0.0	0	0.0	0	0.0
ICHO	bS wP	54	0.2	0	0	0	0	0	0.0	0	0.0	0	0.0
Total		**37,087**		**922**	**0**	**1,053**	**0**	**1,975**		**0**		**1,975**	

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	922	0	Old Forest	1,819	0
			Operational Non Designated Parks and Reserves	0.1	0

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

Appendix 6: Description of Road Density Index

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

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

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

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

Main Concepts

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

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

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

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

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

DNR Forestry Branch maintains a table relating the topographic series attribute coding used by the Geomatics Centre to the feature categories used in the Road Index calculations, along with ArcvView 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	386
Utility corridors	3	43
Gravel roads and active railways	6	270
Paved streets and roads collectors	10	63
Highways	15	3

Table 2: Distribution of Road Index Classes

Road Index Value		Area of Ecodistrict Affected	
Indication	**Range**	**Hectares**	**Percent**
Remote	0 to 6	2,039	5.5
Forest Resource	7 to 15	15,562	42.0
Mixed Rural	16 to 24	12,141	32.7
Agriculture Suburban	25 to 39	6,898	18.6
Urban	40 to 100	435	1.2
Total		**37,074**	**100**

Table 3: Road Index Values for Each Landscape Element Type

Landscape Element	Area (ha)	Road Index
Valley Corridors	908	46.6
Tolerant Mixedwood Slopes	1,196	11.6
Tolerant Mixedwood Hills	21,248	10.2
Red Spruce Hummocks	13,370	8.1
Spruce Pine Hummocks	52	26.4
Total	**36,774**	**10.7**

*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

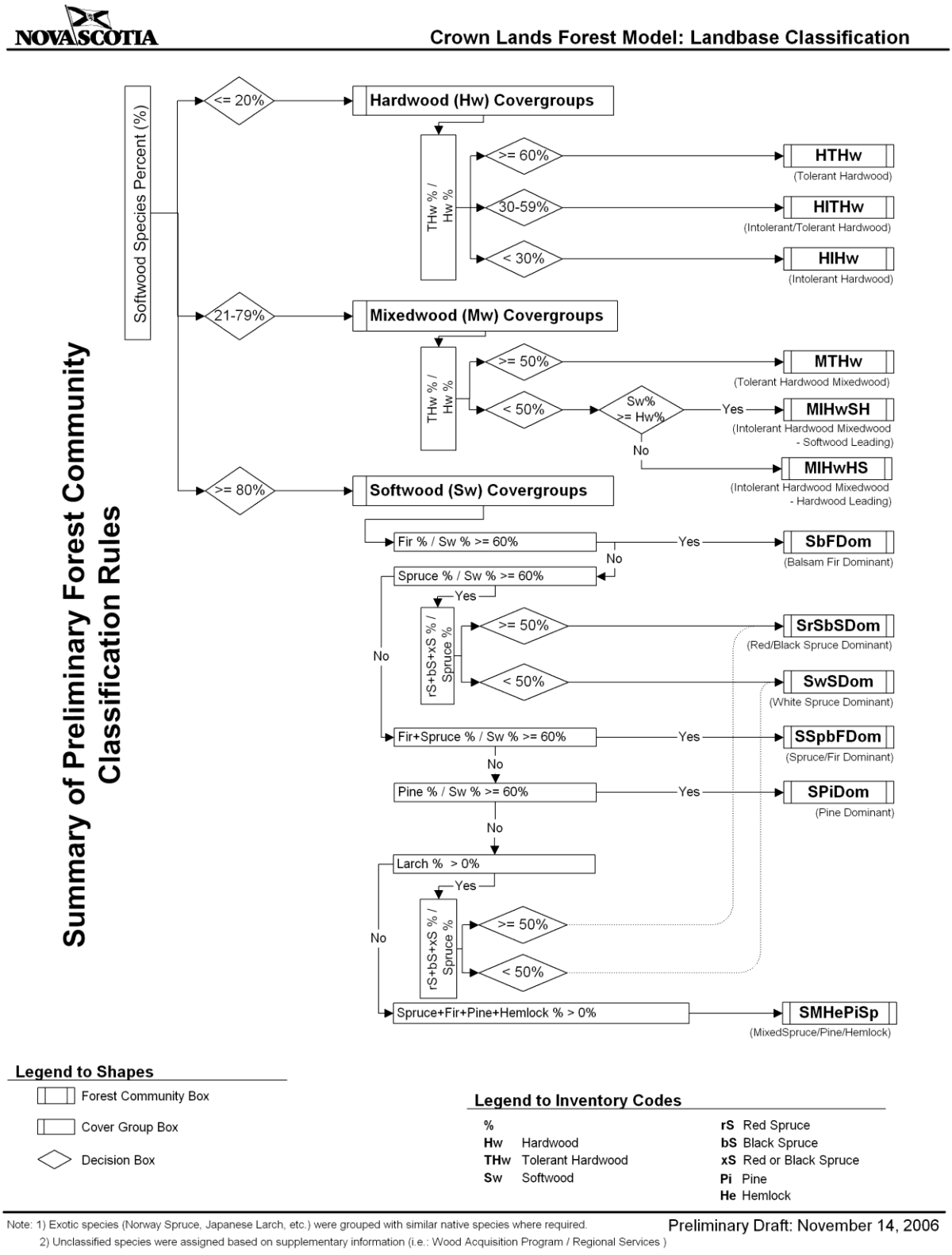
Development Class	Seral Stage
1. Forest Establishment (Height 0 to 6 m) • establishment of new growth following a stand-initiating disturbance • high diversity of forbs, shrubs, and tree regeneration, many of which are short-live shade-intolerant "pioneer" species • peak seed production by forbs and 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
4. Multi-aged and old growth forest (Varying height and age and Old Growth ID) • dominant overstory exhibiting a variety of crown sizes and canopy densities • canopy gaps promote development of multi-layered understory and recruitment to overstory	Early Seral Species (Score 10 to 23) • canopy likely to break up and be replaced by developing understory Mid Seral Species (Score 24 to 37) • pioneer dominated overstory with canopy recruitment from a climax species-dominated understory Late Seral Species (Score 38 to 50) • climax species-dominated overstory maintained through gap dynamic processes

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

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

A look-up table assigns each species in the forest inventory a value from 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 to 23 early, 24 to 37 mid, and 38 to 50 late.

Appendix 9: Vegetation Community Classification – Forest Model



Appendix 10: Table 1: Forest Landscape Composition Worksheet (Cobequid Slopes 350)

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)				
Red Spruce Hummocks	IMHO (51.0%) WMHO (33.0%) IMRD (16.0%)	Softwood	rS bS	Infrequent	13,334; 99.7	Early	173	157	131	36	498	7,568; 64.0	EARLY	2,371; 20.0
						Mid	256	151	174	53	635			
						Late	59	109	792	81	1,041			
						Uncl	347	0	0	0	347			
		Mixedwood	rS sM yB Be rS eH wP sM yB Be	Gap	24; <1.0	Early	8	45	31	14	98	2,600; 22.0	MID	3,300; 28.0
						Mid	78	100	101	67	345			
						Late	8	37	170	34	248			
						Uncl	119	0	0	0	119			
		Hardwood				Early	22	16	4	3	44	1,142; 10.0	LATE	3,835; 32.0
						Mid	5	24	45	0	73			
						Late	3	16	146	4	168			
						Uncl	1	0	0	0	1			
		Unclassified				Early	30	0	0	0	30	540; 4.0	UNCL	2,345; 20.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	128	0	0	0	128			
Total					**13,371***	**(ha)**	**1,235**	**654**	**1,592**	**292**	**3,774**			
						%	**32.7%**	**17.3%**	**42.2%**	**7.7%**	**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 (Cobequid Slopes 350)

Element	Ecosection (% land area)	Covertype	Climax Species (M=Mid; L=Late Seral)	Natural Disturbance Regime	Total Land Area of Potential Forest (ha; %)	Seral Stage	Current Forest - GIS Inventory							
							Development Class (ha)				Total Forested Area (ha)	Covertype (ha; %)	Seral Stage Summary (ha; %)	
							Establish-ment (1)	Young Forest (2)	Mature Forest (3)	Multi-aged (4)				
Tolerant Mixedwood Hills	IFKK (44.0%) WCKK (33.0%) WMKK (15.0%) WCHO (6.0%) WFKK (2.0%)	Softwood	rS bS	Infrequent	13; <1.0	Early	495	523	1,810	391	3,220	8,400; 47.0	EARLY	5,423; 30.0
						Mid	253	236	797	216	1,502			
						Late	106	110	1,213	211	1,639			
						Uncl	2,039	0	0	0	2,039			
		Mixedwood	rS sM yB Be rS eH wP sM yB Be	Infrequent	21,213; 99.0	Early	285	284	695	217	1,481	5,231; 29.0	MID	4,520; 25.0
						Mid	457	243	1,050	294	2,044			
						Late	20	83	857	170	1,129			
						Uncl	578	0	0	0	578			
		Hardwood	aE sM wA	Gap	4; <1.0	Early	76	90	388	4	558	3,495; 19.0	LATE	4,607; 26.0
						Mid	99	189	671	15	974			
						Late	40	123	1,595	81	1,839			
						Uncl	124	0	0	0	124			
		Unclassified				Early	162	2	0	0	164	905; 5.0	UNCL	3,480; 19.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	741	0	0	0	741			
Total					**21,250***	**(ha)**	**5,474**	**1,881**	**9,076**	**1,599**	**18,031**			
						%	**30.4%**	**10.4%**	**50.3%**	**8.9%**	**100.0%**			

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

Appendix 10: Table 1: Forest Landscape Composition Worksheet (Cobequid Slopes 350)

Element	Ecosection (% land area)	Covertype	Climax Species (M=Mid; L=Late Seral)	Natural Disturbance Regime	Total Land Area of Potential Forest (ha; %)	Seral Stage	Current Forest - GIS Inventory							
							Development Class (ha)				Total Forested Area (ha)	Covertype (ha; %)	Seral Stage Summary (ha; %)	
							Establish-ment (1)	Young Forest (2)	Mature Forest (3)	Multi -aged (4)				
Tolerant Mixedwood Slopes	WMDS (73.0%) WCDS (26.0%)	Softwood	rS bS	Infrequent	11; 1.0	Early	22	31	59	5	117	634; 55.0	EARLY	171; 15.0
						Mid	64	34	66	15	179			
						Late	12	18	209	22	261			
						Uncl	77	0	0	0	77			
		Mixedwood	rS eH wP sM yB Be rS sM yB Be	Gap	1,182; 99.0	Early	6	3	14	8	32	368; 32.0	MID	378; 32.0
						Mid	31	29	56	34	150			
						Late	1	14	105	10	130			
						Uncl	56	0	0	0	56			
		Hardwood				Early	0	12	3	0	14	144; 12.0	LATE	462; 40.0
						Mid	0	30	12	7	48			
						Late	3	6	58	5	72			
						Uncl	9	0	0	0	9			
		Unclassified				Early	8	0	0	0	8	18; 1.0	UNCL	153; 13.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	10	0	0	0	10			
Total					**1,196***	**(ha)**	301	177	581	106	1,164			
						%	**25.8%**	**15.2%**	**49.9%**	**9.1%**	**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 (Cobequid Slopes 350)

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	IMSM (33.0%) WCHO (16.0%) WCDS (11.0%) WMHO (10.0%) IFKK (7.0%) WMDS (4.0%) WCKK (3.0%) WMKK (3.0%) IMRD (2.0%)	Softwood	rS (11%) bS (4%)	Infrequent	136; 15.0	Early	3	7	75	15	100	274; 58.0	EARLY	158; 33.0
						Mid	0	3	45	13	61			
						Late	5	0	49	4	58			
						Uncl	54	0	0	0	54			
		Mixedwood	rS sM yB Be rS eH wP sM yB Be	Infrequent	393; 43.0	Early	1	8	21	6	35	132; 28.0	MID	139; 29.0
						Mid	7	11	38	10	66			
						Late	0	3	21	6	29			
						Uncl	2	0	0	0	2			
		Hardwood	aE sM wA	Gap	273; 30.0	Early	2	4	14	0	21	54; 12.0	LATE	108; 23.0
						Mid	0	0	12	0	12			
						Late	0	3	18	0	21			
						Uncl	0	0	0	0	0			
		Unclassified				Early	1	0	0	0	1	13; 2.0	UNCL	68; 15.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	12	0	0	0	12			
Total					**908***	**(ha)**	**89**	**39**	**293**	**53**	**473**			
						%	**18.8%**	**8.1%**	**61.8%**	**11.3%**	**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 (Cobequid Slopes 350)

Element	Ecosection (% land area)	Covertype	Climax Species (M=Mid; L=Late Seral)	Natural Disturbance Regime	Total Land Area of Potential Forest (ha; %)	Seral Stage	Current Forest - GIS Inventory							
							Development Class (ha)				Total Forested Area (ha)	Covertype (ha; %)	Seral Stage Summary (ha; %)	
							Establish-ment (1)	Young Forest (2)	Mature Forest (3)	Multi -aged (4)				
Spruce Pine Hummocks	ICHO (99.0%)	Softwood	bS wP	Frequent	53; 99.0	Early	0	0	0	0	0	1; 8.0	EARLY	10; 65.0
						Mid	0	0	1	0	1			
						Late	0	0	0	0	0			
						Uncl	0	0	0	0	0			
		Mixedwood				Early	0	0	8	0	8	10; 66.0	MID	2; 17.0
						Mid	0	1	0	0	1			
						Late	0	0	0	0	0			
						Uncl	0	0	0	0	0			
		Hardwood				Early	0	0	1	0	1	1; 8.0	LATE	0 0.0
						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	3; 18.0	UNCL	3; 18.0
						Mid	0	0	0	0	0			
						Late	0	0	0	0	0			
						Uncl	3	0	0	0	3			
Total					**54***	**(ha)**	**3**	**1**	**11**	**0**	**14**			
						%	**18.1%**	**6.9%**	**75.0%**	**0.1%**	**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 Cape Breton Highlands Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Red Spruce Hummocks	IMHO WMHO IMRD	Infrequent Infrequent Infrequent	rS rS sM yB Be rS	S	SrSbSDom	4,480	39.6%	L	**Well-drained** Early VT: rM, wB, tA, bF Mid VT: rM, bF, rS Late VT: rS, yB **Moist** Early VT: bS, rS, bF, rM, tA Mid VT: bF, rS, yB, rM Late VT: rS, yB
				S	SbFDom	1,451	12.8%	E	
				M	MTHw	1,132	10.0%	L	
				M	MIHwSH	959	8.5%	E/M	
				S	SspbFDom	845	7.5%	E/M	
				S	SwSDom	752	6.6%	E	
				H	HTHw	624	5.5%	L	
				M	MIHwHS	509	4.5%	M	
				H	HIHw	438	3.9%	E	
				H	HITHw	80	0.7%	M/L	
				S	SpiDom	32	0.3%	L	
				S	SMHePiSp	8	0.1%	L	
Total						**11,310**	**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 Cape Breton Highlands Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Tolerant Mixedwood Hills	IFKK WCKK WCHO WMKK WFKK	Infrequent Infrequent Infrequent Infrequent Infrequent	rS sM yB Be rS sM yB Be rS sM yB Be rS sM yM Be rS sM yB Be	S	SrSbSDom	3,257	19.0%	L	**Well-drained** Early VT: rM, wB, tA, bF Mid VT: rM, bF, rS Late VT: rS, yB **Moist** Early VT: bS, rS, bF, rM, tA Mid VT: bF, rS, yB, rM Late VT: rS, yB
				S	wS	2,695	15.7%	E	
				M	MIHwSH	2,311	13.5%	E/M	
				H	HTHw	2,011	11.7%	L	
				S	SbFDom	1,642	9.6%	E	
				M	MTHw	1,592	9.3%	L	
				M	MIHwHS	1,328	7.8%	E/M	
				H	HIHw	1,088	6.4%	E	
				S	SspbFDom	748	4.4%	M	
				H	HITHw	396	2.3%	M	
				S	SPiDom	37	0.2%	L	
				S	SMHePiSp	21	0.1%	L	
Total						**17,126**	**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 Cape Breton Highlands Grouped by Landscape Element)

Element	Ecosections	Dominant ND	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Tolerant Mixedwood Slopes	WMDS WCDS	Gap Gap	rS eH wP sM yB Be rS eH wP sM yB Be	S	SrSbSDom	366	31.9%	L	**Well-drained** Early VT: rM, wB, tA, bF Mid VT: rM, bF, rS, yB Late VT: eH, wP, rS, sM, yB, Be
				M	MTHw	199	17.3%	L	
				S	SbFDom	125	10.9%	E	
				M	MIHwSH	101	8.8%	E/M	
				S	SspbFDom	74	6.5%	M	
				H	HTHw	72	6.3%	L	
				S	SwSDom	69	6.0%	E	
				M	HITHw	68	5.9%	E/M	
				H	HIHw	67	5.8%	M	
				H	HITHw	6	0.5%	M/L	
Total						**1,147**	**100.0%**		

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

Appendix 10: Table 2: Composition of Forest Communities (in Cape Breton Highlands Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Valley Corridors	IFKK IMHO IMRD IMSM WCDS WCHO WCKK WMHO WMKK	Infrequent Infrequent Infrequent Gap Gap Infrequent Gap Infrequent Infrequent	rS, sM, yB, Be rS, sM, yB, Be rS, sM, yB, Be aE sM wA rS eH wP sM Yb Be rS sM yB Be rS sM yB Be rS rS sM yB Be	S	SrSbSDom	105	22.8%	L	Various successional types pending ecosection (see above)
				S	wS	85	18.5%	E	
				M	MTHw	61	13.3%	L	
				S	SbFDom	57	12.4%	E	
				M	IHWSH	55	12.0%	E/M	
				S	SspbFDom	27	5.9%	M	
				H	IH	24	5.2%	E	
				H	TH	22	4.8%	L	
				H	IHTH	8	1.7%	M	
				M	MIHwSH	16	3.5%	E/M	
Total						**460**	**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 Cape Breton Highlands Grouped by Landscape Element)

Element	Ecosections	Dominant NDR	Dominant Climax Type	Covertype	Forest* Community (Crown Model)	Area (ha)	Percent of Forest Community	Successional Stage	Successional Types
Spruce Pine Hummocks	ICHO	Frequent	bS, wP	M	IH(SL)	8	66.7%	E/M	**Moist** Early VT: bS, wP, rM edaphic vegetation types
				M	IH(HL)	2	16.7%	E/M	
				H	IH	1	8.3%	E	
				S	SrSbSDom	1	8.3%	L	
Total						**12**	**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
rS sM yB Be	21,517	58.0%	38,966	4.0%
rS	12,631	34.0%	98,853	10.0%
rS eH wP sM yB Be	1,330	4.0%	6,220	0.6%
bS	909	3.0%	95,246	10.0%
aE sM wA	499	1.0%	11,096	1.0%
bS wP	54	0.1%	43,237	5.0%
Total	**36,940**	**100.0%***	**293,618**	**30.6%****

*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	Intensive Forest Management Area (ha)	Conversion to Non-Forest Area (ha)	Unclassified Land Use Area (ha)	Effective Area Range (ha)	EEC Index Range
Tolerant Mixedwood Hills	21,231	989	11,467	2,269	2,864	3,642	11,067 to 12,888	52 to 61
Red Spruce Hummocks	13,362	947	8,088	839	1,058	2,430	7,830 to 9,045	59 to 68
Tolerant Mixedwood Slopes	1,194	25	918	67	15	169	773 to 857	65 to 72
Valley Corridors	1,064	13	558	158	249	86	492 to 535	46 to 50
Spruce Pine Hummocks	54	0	17	9	25	3	16 to 17	30 to 32
Total	**36,905**	**1,974**	**21,048**	**3,342**	**4,211**	**6,330**	**20,177 to 23,342**	**55 to 63**

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	55	0	18	9	25	3	16 to 18	30 to 32
IFKK	9,431	0	4,444	1,441	1,606	1,941	4,178 to 5,149	44 to 55
IMHO	6,865	947	4,134	361	294	1,129	4,420 to 4,984	64 to 73
IMRD	2,135	0	1,389	158	173	414	1,185 to 1,392	56 to 65
IMSM	555	0	228	105	178	45	208 to 230	38 to 42
WCDS	416	27	337	18	17	17	289 to 297	69 to 71
WCHO	1,395	52	754	154	206	230	713 to 828	51 to 59
WCKK	7,018	948	4,513	395	247	915	4,660 to 5,118	66 to 73
WFKK	427	0	141	73	187	26	130 to 143	31 to 34
WMDS	914	1	697	54	9	153	575 to 652	63 to 71
WMHO	4,486	0	2,633	334	615	903	2,284 to 2,736	51 to 61
WMKK	3,246	0	1,782	245	658	561	1,538 to 1,818	47 to 56
Total	**36,943**	**1,975**	**21,070**	**3,347**	**4,215**	**6,337**	**20,198 to 23,365**	**55 to 63**

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 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).

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