ECOLOGICAL LAND CLASSIFICATION
for NOVA SCOTIA
Volume 1 - Mapping Nova Scotia's Terrestrial Ecosystems

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Ecoregions and Ecodistricts of Nova Scotia. Environment Canada. 1999. K.T.Webb and I.B.Marshall

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INTRODUCTION

When land is classified from an ecological perspective areas of similar ecology are identified and mapped in an ecological land classification (ELC). Within the classification the ecological information is presented in a hierarchy of ecosystems where broad to specific levels of detail are presented on a series of maps. In this framework the ELC provides a description of the physical and biological environment affecting the ecological structures and processes and the biodiversity of ecosystems. As one of the major tools required for planning and managing sustainable forests an ELC provides a common language for discussions concerning biodiversity, forest ecosystems and resource management. Within an ELC an appropriate level of ecosystem information and representation can be selected to use in the planning and managing for the various elements of biodiversity such as individual species, habitats, ecosystem structures, age class, species associations or genetics.

As a signatory to the National Forest Strategy (1998) and the Canadian Biodivesity Strategy (1995) Nova Scotia has recognized the importance of an ELC for forest ecosystem management. The ecological information in an ELC concerning the structures and functions and distribution of forest ecosystems will assist forest planners and managers of all land tenures in Nova Scotia.

The following text will provide the methodology for mapping Nova Scotia's ecological land classification. A description of the various units is also provided. Volume 2 (in progress) will provide an interpretation for the natural disturbance regimes within an ELC and Volume 3 (in progress) will examine the potential climax forests for each of the levels of the ELC.

Mapping ELC Units

Matson and Power (1996) state that there is more to an ELC than just the identification and mapping of ecosystems since it provides an understanding of ecosystem form and function by linking abiotic and biotic components of each system. Ecosystems within the ELC must be more than a concept to be useful, they must be delineated on the landscape and described in order to manage ecologically. In Ontario, Hills (1959) recognized the effects of interactions of climate, landform and soils on the distribution of vegetation and divided the province into broad macroclimatic regions within which distinct physiographic areas were delineated. Webb and Marshall (1999) suggest that the fundamental basis for delineation of ecological units is to capture the major ecological composition and the linkages between the various components (e.g., landforms, soils, water, and vegetation) rather than treating each component as a separate characteristic of the landscape. The key elements in the application of ecological land classification in delineating map units are as follows (Wiken and Gauthier 1996; Commission for Environmental Cooperation 1997):

- an ELC incorporates all the major components of ecosystems: air, water, land and biota.
- the ELC is holistic since "the whole is greater than the sum of its parts".
- the number and relative importance of factors helpful in delineating ecological units vary from one area to another, regardless of the level of generalization.
- the ELC is based on a hierarchy, with ecosystems nested within ecosystems.
- an ELC involves integration of knowledge and is not simply an overlay.
- an ELC recognizes that ecosystems are interactive and that characteristics of one ecosystem blend with those of another.
- map lines in an ELC generally depict the location of zones of transition.

Even though ELC is science based there is a need to recognize that some interpretation is required in order to reduce the complexity of ecosystems and to make map units workable and understandable. Ecosystems are best described based on enduring components that will not change significantly over time, such as geology, surficial materials, landform and topography. The differentiating criteria of ecosystems at each level of generalization may vary since not all components may be equally significant throughout the classification. Therefore, the spatial expression will be determined by the dominant component of the ecosystem which may vary from one ecological unit to the next, as well as their relationships and processes.

Ecosystem boundaries on a map represent a consistent or significant degree of change when compared to adjacent units. Since multiple factors contribute to the placement of boundaries on an ecological map it is important to be able to understand how these will ultimately influence biodiversity when the physical or biological components of an ecosystem are changed. Climate can be used to separate ecodistricts on Cape Breton Island and most notably along the Atlantic coastline as reflected by changes in vegetation. Other parts of Nova Scotia will notice changes in vegetation due to changes in landform/topography such as the drumlinized till plain of the Lunenburg Drumlins ecodistrict and the adjacent gently undulating topography of the Rossignol ecodistrict.

A Hierarchical Classification

Nova Scotia's ELC provides a systematic methodology for explaining the distribution and composition of the terrestrial landscapes. By nesting the ecosystems within a hierarchy and providing a linkage between those the size of forest stands to those the size of climate regions, an effective mechanism is now available that permits the choice of detail that suits management objectives and use. Nova Scotia's Ecological Land Classification (ELC) is comprised of five levels (Table 1) and uses abiotic (physical) and biotic (biological) environmental attributes to define ecosystems. The ecological units are on a series of maps (NSDNR, 2001a) with further detail available in the accompanying text of this document. Digital data as Arc/Info Coverages and Arc/Info

Export E00 files is also available (NSDNR, 2001b). Maps and text can also be viewed on the Department of Natural Resources website (http://www.gov.ns.ca/natr/).

Table 1. Hierarchical levels of the Nova Scotia Ecological Land Classification

Ecological Unit	Map Scale	# of Units	Criteria for Delineating Unit
Ecozone	1:1,000,000	1	global or continental climate as reflected by vegetation
Ecoregion	1:500,000	9	provincial climate as expressed through soils and vegetation
Ecodistrict	1:250,000	39	subdivisions of ecoregions characterized by distinctive assemblages of relief, geology, landform, soils and vegetation
Ecosection	1:50,000	637[1]	a repeating pattern of landform/topography, soils and vegetation throughout an ecodistrict. A maximum of 63 combinations of the physical attributes are possible.
Ecosite	1:10,000	n.a.	a uniformity of parent material, soils, vegetation and hydrology as expressed by slope, position on slope, aspect and exposure

[1] Approximate since not all ecosections are found in every ecodistrict. Assumes that a level of uniqueness exists between similar ecosections in different ecodistricts.
n.a. - not available

METHODOLOGY

There are many data sources available for Nova Scotia which describe the various criteria required for delineating ecosystems within a hierarchical classification (Table 2). The Department of Natural Resources (formerly Department of Lands and Forests) completed a hierarchical biophysical land classification in 1986. The physical attributes of the smallest units, *land systems,* were delineated on 1:63,560 infrared aerial photographs and transferred to maps at a scale of 1:50,000. The land system polygons were digitized and their attributes (Appendix 1) coded within the Department's geographic information system (GIS). This digital data became known as the

BIOSYS layer within the GIS. An evaluation of the 10 mapped physical attributes (Table 3) determined that forest ecosystems and their associated biodiversity could accurately be reflected by using soil texture, soil drainage, landform and topographic pattern (relief was also used to define boundaries). Further analysis and field checking revealed that the complexity of the biophysical land system could be reduced by aggregating similar polygons (Appendix 1). By using these enduring features as a building block for a hierarchical classification of ecosystems, mapping can progress to delineate the various levels of ecosystems within an ELC. As a nested hierarchy the boundaries of each polygon/ecosystem are constrained by the level of the ELC immediately above.

Classification and mapping of an ELC is hierarchical because climate (ecoregion) exerts an influence on the forest composition that cannot be explained by the lower levels (Matson and Power 1996). For example, along the Atlantic coast of Nova Scotia forest communities developing on similar geology/landforms and soils that are found inland will be different due to the influence of the coastal climate. Thus by separating the climatic influence at an upper level of the ELC the differences in forest composition within an ecoregion or ecodistrict can be explained by knowing that their compositional differences are controlled by landform and soil fertility/moisture relationships and not climate.

Table 2. Sources of information used to delineate Nova Scotia's Ecological Land Classification.

Ecological Unit	Sources of Information Used to Delineate Units
Ecozone	Forest Regions of Canada (Rowe 1972) National Ecological Framework for Canada (Ecological Stratification Working Group 1996)
Ecoregion	Climatic Regions of Nova Scotia (Nova Scotia 1986) Canadian Climate Normals 1961-90 (Environment Canada 1997) The Climate for Agriculture in Canada (Dzikowski 1985)
Ecodistrict	3-D Radarsat-1 Mosaic (COGS 1999) photography National Topographic Series 1:50,000 contour mapping Surficial and bedrock geology mapping of Nova Scotia. Forest classification (Loucks 1962)
Ecosection	Biophysical Land Classification for Nova Scotia Forestry Cover Type Mapping Provincial Soils Mapping 1:63,560 infrared aerial photographs (1975,1976) 1:10,000 true colour aerial photographs (1988 +)

GIS Aggregation of the BIOSYS Layer

An algorithm was designed to group similar land system polygons within the BIOSYS layer. Maps were produced at a scale of 1:50,000 which showed the results of the aggregation and which now represent a potential boundary for the ecosections level of the ELC. Each of the ecosections were assigned unique colours and a four digit code to describe the soil drainage, soil texture and topographic/landform pattern. Every map sheet was reviewed for the following:

- a systematic search for errors or inconsistency in the assignment of biophysical attributes (required spot re-interpretation of the 1:63,560 aerial infrared photography; re-examination of soil mapping, surficial and bedrock geology mapping)
- transfer errors during digitizing of the land systems from the 1:50,000 maps to the GIS
- evaluation of small and/or unique ecosections from the aggregation routine (often required field checking)

Table 3. Biophysical attributes delineated in Nova Scotia's Biophysical Land Classification

Biophysical Attribute	Number of Classes	Description
Topographic pattern	10*	the physical features of an area such as land shape and relief
Slope class	5	percent slope of the land
Relief class	5*	the difference between extreme elevations within a given area
Landform	23	various shapes of the land resulting from a variety of geological processes
Soil drainage class	3**	describes the removal of excess soil water
Soil texture class	7	describes the relative proportion of sand, silt, clay and coarser materials in a mineral soil
Stoniness code	6	surficial stoniness and the degree of interference to mechanical equipment
Parent rock type	17	the rock from which the parent materials of soils are formed
Bedrock exposure	%	proportion of area with bedrock exposed or within 15-25 cm of the surface

- Complex types of up to two could be described.

** Percentages were determined for each of the three drainage classes for each land system

Areas with similar biophysical attributes as coded within the GIS BIOSYS layer were combined if the differences were considered to have an insignificant impact on biodiversity at the ecosection level of mapping. The three attributes used from the BIOSYS land system layer were soil texture, soil drainage and topographic pattern.

Soil Drainage

Soil drainage is described for each land system polygon as a percentage of the well drained, imperfectly drained and poorly drained soils. For the purpose of delineating ecosections the following was used:

ELC Code	Description	Definition
W	Well drained soils	Land Systems comprised of soils >60% well drained
P	Poorly drained soils	Land Systems comprised of soils >60% poorly drained
I	Imperfectly drained soils	Land Systems not well or poorly drained.

Soil Texture

There are seven land system attributes for soil texture. For the purpose of delineating ecosections the following was used:

ELC Code	Description	Definition
C	Coarse textured soils	gravel, coarse sand, sand, loamy sand and coarse sandy loam (note: soils with a high content of gravel were also included in this category)
M	Medium textured soils	sandy loam, fine sandy loam, very fine sandy loam, loam
F	Fine textured soils	silt, sandy clay loam, clay loam, sandy clay, silty clay, clay

Topographic Pattern

There are ten land system attributes for topographic pattern. These attributes can occur singularly or paired within a land system complex.

ELC Code	Description	Definition
SM	Smooth or Flat (Level) e.g. floodplain, lake plain, deltas, intervales, and open bogs and wetlands	land with no particular pattern, flat or very gently sloping, uni-directional surface with a generally constant slope not broken by marked elevations and depressions. Slopes are generally less than 1%.
HO	Hummocky	a series of small rounded hills with a gentle slope usually never exceeding 15%
KK	Hills	a series of knobs and knolls with moderate to steep slopes between 5-30%. Relief amplitude ranges from 15 - 60 m.
DM	Drumlinoid	a pattern of elongated landforms caused by glacial ice movement (drumlins and flutes) often occurring in clusters
R	Ridges	a pattern of linear or curvilinear ridges
DS	Canyons and Steep Slopes	Sharply sloped terrain along rivers/streams or associated with hilly topography. Slopes usually between 20 - 80 %.

RESULTS

The classification has five hierarchical levels whose cartographic boundaries fit together perfectly. Each level is defined by a set of ecological factors. The number and precision of these increase from the continental scale to the local scale. The followingtext describes each level of the

ELC. The ecoregions and ecodistricts are illustrated in Figure 1 http://gis1.gov.ns.ca/website/nselcmap .

The maps were produced from different sources of data available systematically for the entire area. It results from the spatial integration of climatic data, ecological land classification results and synthetic mapping units of physical environment features. The requirement to identify meaningful units that fulfill an opportunity for management necessitated that some ecological uniqueness may be compromised for logistical reasons. Nonetheless, a hierarchical system still allows for this uniqueness to be identified and acted upon accordingly as part of any management strategy for ecological resources.

Ecozone

Ecosystems at this scale are usually described on a global/continental scale. In Canada it is representative of large and very generalized ecological units characterized by interactive and adjusting abiotic and biotic factors. Basically they are the broad mosaics formed by the interaction of macroclimate, human activity, vegetation, soils, geological and physiographic features of the country (Ecological Stratification Working Group, 1996). Usually the forest vegetation is a reflection of the macroclimatic elements such as solar radiation and heat totals. In Nova Scotia, the **Acadian Forest,** as described by Rowe (1972) is " a major geographic belt or zone, characterized vegetationally by a broad uniformity both in physiognomy and in the composition of the dominant tree species". This unit has been adopted as the Acadian Ecozone, and is the only ecozone within the province. It is called the Atlantic Maritime ecozone by the Ecological Stratification Working Group (1996).

Ecoregions

Ecoregions are subdivisions of the larger Acadian ecozone and express macroclimate as a distinctive ecological response to climate through soils and vegetation. Rowe (1972) defines ecoregions as representations of broad provincial climatic patterns as expressed by the macro-features of vegetation: the distribution and range of conspicuous tree species, their life-forms (broadleaved or needle-leaved), the physiognomy and relative areal extent of the communities in which they are associated, and the patterning of the total vegetation. In Nova Scotia climate is often conferred as a result of the proximity to the cool salt waters along the coast or by elevation. Therefore, at this scale, boundaries drawn on the basis of these criteria are often coincident with the major physiographic features and ecoregions can be delineated around topography that has distinct differences in climate and/or proximity to the ocean. Regardless, the delineation of climatic zones in the province is rendered difficult and the boundaries are fuzzy due to the often mixing effects of coastal proximity and elevation. Climatic factors that affect the variety of biodiversity on terrestrial

ecosystems also includes some elements of weather data that are not always used when determining the typical climatic zone. Minimum winter temperatures and snowfall are two factors that were considered in the determination of ecoregional boundaries in Nova Scotia. Soil, water and fauna also mirror the interaction of climate and vegetation at this scale. Vegetation patterns are strongly correlated with these climatic influences and the terrestrial ecosystems of each region display distinctive characteristics. Nine ecoregions have been mapped for Nova Scotia (Figure 1) http://gis1.gov.ns.ca/website/nselcmap ranging in size from 444 km^2 to 16,906 km^2.

Ecodistricts

Ecodistricts are subdivisions of the ecoregions and reflect macroelements of the physical and biological attributes of the ecosystems which will ultimately influence biodiversity. Ecodistricts are major landforms within an ecoregion with geology and soils distinct from adjacent ecodistricts. Matson and Power (1996) state that ecodistricts indicate the principal regulators of meso-scale climate influences and the supply of soil nutrients (and moisture) which together influences all terrestrial and aquatic ecosystems. These elements of the ecodistricts include microclimate, physiography, geology, geomorphology, soils and moisture. One dominant element can usually be selected as the defining characteristic and is reflected in the biodiversity of the ecodistrict. In Nova Scotia physiographical features resulting from geological history can be used to separate the uplands and lowlands. Due to the diversity of landform caused by glacial activity many of the province's ecodistricts can also be identified by landforms and surficial geology. Variation at an ecodistrict level will also be recognized along the coastal areas of Nova Scotia due to the influence of warmer and colder off-shore currents. Other districts can be distinguished based on the underlying effects of bedrock geology as expressed through soil lithology.

Within ecodistricts there will be a variability of biodiversity expressed due to the complexity of the interactions between the physical and biological attributes of the ecodistrict. This often confuses the mapping effort at this scale but if a strict application of the delineating criteria is maintained a meaningful and manageable unit can be described. The benefits of a hierarchical classification can be utilized at this level as this detail and complexity can be mapped at lower levels of the ELC. Nonetheless, as more data is collected and analyzed boundaries of any ecological unit can be adjusted to reflect and capture the complexity. Thirty-eight ecodistricts have been mapped for Nova Scotia (Figure 1) http://gis1.gov.ns.ca/website/nselcmap ranging in size from 126 km^2 to 6,481 km^2. Climatic data for the ecodistricts is presented in Appendix I.

Ecosections

These are the smallest mapped units of this current version of the ELC and are repetitive subdivisions of the ecodistrict. As the building block for the ELC this unit describes the enduring physical features - topographic pattern, soil texture and soil drainage. At this level biological processes such as climax forest association and natural disturbance regime can be determined. Together the physical and biological attributes of the ecosection determine the ecological processes and structures affecting biodiversity. Each ecodistrict will have several dominant ecosections repeating across the landscape which may be unique to that ecodistrict. Ecodistricts within the same ecoregion are more than likely to share ecosections with perhaps no noticeable physiognomic differences. However, floristic variability and contrasting response to management inputs can be expected. Significant differences in both physiognomic and floristic components as well as response to management inputs will be expected between ecosections of different ecoregions.

Ecosections have a natural disturbance regime that maintains or rejuvenates the forest ecosystem. The frequency of these natural disturbances is a function of the forest species that occur in the ecosection. Forest ecosystems unaffected by human disturbances such as tree harvesting or protection from fire and insect damage can be expected to reach a climax or steady state at which time the natural disturbance can be expected to occur as conditions (climatic or biological) dictate. Wetland ecosystems are classified as poorly drained ecosections of smooth topography, i.e. PCSM, PMSM and PFSM. In this classification these wetlands include areas which are forested and non-forested. A further classification of wetlands has been undertaken to describe such features regarding water and nutrient source, vegetation, etc. (NSDNR 2000).

Ecosites

Mapping of ecosites scheduled for 2004.

As a subdivision of an ecosection, ecosites describe a suite of site conditions including elevation, slope, slope position, aspect, soil drainage and soil texture that can be used to predict forest communities, their species, successional development and productivity. These units are usually mapped at a scale of 1:10,000 to 1:50,000 but in Nova Scotia will most likely be at the finer scale in order to be compatible with currently used inventories such as the forest cover layer in the provincial GIS. Management applications for ecosites will include forest/landscape level planning, forest ecosystem management prescriptions (including habitat supply modeling), silviculture prescriptions and estimating wood supply.

OTHER CLASSIFICATIONS

There have been several other classifications for Nova Scotia which have prepared maps and documentation describing various components of the province's natural ecology. These classifications include:

- Natural History of Nova Scotia Theme Regions, Volume 2 (Davis and Browne, 1996)
- Natural Landscapes of Nova Scotia (NSDNR, 1997)
- Biophysical Land Classification for Nova Scotia (NSDLF, 1986)
- A Forest Classification for the Maritime Provinces (Loucks, 1962)
- National Ecological Framework for Canada (Ecological Stratification Working Group, 1996)
- Ecoregions and Ecodistricts of Nova Scotia (Webb and Marshall, 1999)

Each of the above classifications have been used extensively for the purposes that they were designed. Not surprisingly the classifications have many similarities to the ELC for Nova Scotia. The strong influence of the maritime climate on soils and vegetation and the diversity of the province's geology has created an environment that is complex yet consistent and thus can be mapped with a fair degree of accuracy. The use of the above classifications has been of great assistance in the preparation of this classification and report.

FUTURE DEVELOPMENT OF THE ELC

Resource managers have had an interest in land classification for at least a hundred years. This particular ELC is a result of the need to describe Nova Scotia's terrestrial ecosystems within a classification that will enable the management and conservation of a wide range of values. Any ELC should never be considered to be a finished product. As Loucks (1962) stated - *maps and descriptions are only as good as the knowledge available at the time of writing (preparation). As more information accumulates, revision is to be expected.* The improvement of the ecoregional boundaries, particularly along the coastal areas will be one such example of potential revision. The influence of such a strong, climate inducing feature as the Atlantic Ocean adds to the complexities of vegetation classification and will be a source of on-going research and development.

DEFINITIONS

Barrens — Land devoid of trees or having only very stunted trees. Typical of extreme climatic conditions due to moisture or wind. In Nova Scotia these areas include lands subjected to repeated wildfires which have depleted soil constituents such as organic

matter and created heath like vegetation communities which have contributed to the formation of hardpans within the soil profile.

Drumlin	A smooth, elongated hill created by flowing glacial ice. They often occur in clusters and have a parallel arrangement. In Nova Scotia, most drumlins are 15m to 50 m high and 800 m to 1,200 m long with a length to width ratio of 2 to 1 and a slope of 5-40%.
Dykelands	Lands where the daily influence of tidal waters has been removed by the construction of dykes on tidal rivers and marshes.
Flute	A low relief moraine with linear furrows and ridges parallel to the direction of glacier flow. Most flutes in Nova Scotia have a slope of 15% or less.
Hummocks	A series of small rounded hills with a height less than 1.5 times their base and a relief amplitude up to 15 m.
Intervales	The smooth to level land located along streams and rivers comprised of alluvial soils.
Knobs	A series of small rounded hills with a height greater than1.5 times their base and a relief amplitude up to 45 m.
Knolls	A series of hills with a height less than 1.5 times their base and a relief amplitude ranging from 15 to 60 m.
Kettles	A series of steep sided conical depressions (donut-like appearance) associated with glacial fluvial deposits. Ranging in depth from 5-20 m.
Marshlands	Lands that are or have been inundated with tidal waters.
Sink Holes	A series of depressions most often steep sided, flat bottomed and associated with lowland areas underlain by gypsum and/or limestone.
Soil Drainage	Poorly Drained - water is removed so slowly in relation to the supply that the soil remains wet for a comparatively large part of the time the soil is not frozen (includes CANSIS (1982) categories poorly and very poorly).

Imperfectly Drained - water is removed from the soil slowly enough in relation to the supply to keep the soil wet for a significant part of the growing season (includes

CANSIS (1982) categories moderately well and imperfectly).

Well Drained - water is removed from the soil readily but not rapidly (includes CANSIS (1982) categories very rapidly, rapidly and well).

Soil Texture — The relative proportions (in per cent) by size of sand, silt and clay particles in a soil. It is normally assessed in the field by touch or in the laboratory by the use of sieves and with reference to the standard soil texture chart.

Wetlands — Land that is saturated with water long enough to promote hydric (characterized by considerable moisture) soils or aquatic processes as indicated by poorly drained soils, hydrophytic (water tolerant) vegetation, and various kinds of biological activity that are adapted to wet environments.

DESCRIPTIONS OF THE ECOLOGICAL LEVELS

Acadian Forest Ecozone

All of Nova Scotia is within the Acadian Forest (eco) Region as described by Rowe (1972). The region includes Prince Edward Island and much of New Brunswick and Maine. A Government of Canada ecological framework (Ecological Stratification Working Group, 1995) described a similar ecozone, including Quebec's Gaspe Peninsula and eastern townships, as the Atlantic Maritime Ecozone.

Nova Scotia's climate has been described as robust winters, reluctant springs, fresh summers and lingering falls (Environment Canada, 2002). Two main factors govern the province's climate. The first is the position of the province, halfway between the equator and the north pole, which produces a temperate climate. The second is the maritime (sea coast) location which results in high humidity. Almost completely surrounded by the cold salt waters of the Atlantic Ocean, the Bay of Fundy and the Gulf of St. Lawrence, Nova Scotia's climate is strongly affected by the seas. However, being on the east coast of the continent in a zone where the prevailing winds are from the west, gives Nova Scotia a modified continental climate, which is characterized by a wide temperature range. The modifying influence of the ocean reduces this range somewhat, resulting in cooler summers and milder winters than the interior of the continent.

The Acadian Ecozone in Nova Scotia has a mixed-forest species composition consisting predominately of conifers, especially on sites where drainage is impeded. The major conifers include red, white, and black spruce; balsam fir; eastern white and red pine; and eastern hemlock. Common hardwoods include red and sugar maple; white and yellow birch; trembling and largetooth aspen; and beech.

Stand-replacing fires are less frequent in the Acadian Ecozone than in other boreal and temperate forests (Wein and Moore 1979). Common, natural disturbances caused by insect epidemics and wind storms often result in sporadic and partial stand mortality. These disturbances may occur only once during the life span of the relatively short-lived balsam fir, but several times during the life of spruce, hemlock and pine. Natural regeneration following a disturbance is usually prolific on most sites due to more than ample precipitation, abundant seed crops of the early successional species such as white birch, red maple and aspen, and the shade tolerance of balsam fir and red spruce. The late successional softwood forests are dominated by red spruce, hemlock and white pine. Yellow birch, beech and sugar maple dominate the hardwood climax associations. White spruce, which is a minor component of the natural forest, forms pure stands on abandoned farmland

in most of the ecozone. White pine occurs in pure stands on old fields located on drumlins, primarily in western Nova Scotia.

100 - Cape Breton Taiga Ecoregion

The Cape Breton Taiga Ecoregion is located atop the highlands plateau, with most of the region contained within the boundaries of the Cape Breton Highlands National Park. It also includes the disjunct area known as Jim Campbells Barren southeast of Cheticamp. The terrain is gently undulating with large expanses of exposed bedrock, ombrotrophic bogs and stunted conifers. This region forms the headwaters for several major rivers in northern Cape Breton and contains the Cheticamp Reservoir, a key component in the Wreck Cove hydroelectric project. The bedrock is primarily composed of igneous and metamorphic rocks. The maximum elevation is 532 m, the highest point in Nova Scotia, while much of the region exceeds 425 m. The total area of this ecoregion is 445 km^2 or 1 % of the province.

The climate of the Taiga Ecoregion is one of the coldest and wettest in Nova Scotia, with harsh, long winters of heavy snowfall, short growing seasons and almost constant winds. The average daily temperature is about 6^o C, with an annual precipitation estimated to be 1600 mm, the largest amount in Nova Scotia. In sheltered areas, isolated patches of snow can be found in July.

Typically, taiga is a transition zone between boreal forest and tundra which favors stunted conifers. The barrens of the Cape Breton Taiga are made up of areas of exposed bedrock that may be completely devoid of vegetation or may be covered in lichens predominately of the genus *Cladina*. Where a thin layer of mineral soil has developed on this bedrock, various mosses, and other plants, including rock polypody, bracken, and three-toothed cinquefoil will establish as well as vigorous populations of ericaceous (heath-like) vegetation such as black crowberry, alpine whortleberry, lowbush blueberry, and mountain cranberry. Stunted black spruce and balsam fir form scattered patches where soil availability permits. Wetter areas are dominated by black spruce and eastern larch, whereas upper slopes contain predominately balsam fir. Nichols (1918) found it common for dwarf trees, only three feet in height, to be 50 years old with some trees reaching ages of at least 150 years. These krummholz (tuckamore) associations develop into relatively closed stands, which are difficult to pass through. They are often devoid of the lichens and ericaceous plants that are common on the barrens. Instead, these plants are replaced with other herbaceous plants, including blue bead lily, goldthread and twinflower, and other mosses and liverworts typical of most coniferous forests. Alder, dwarf birch and mountain ash form buffers along streams. Sedge (*Carex* spp.) and *Sphagnum* spp. moss bogs are another common association of the Taiga Ecoregion. They occur in the form of raised bogs, flat bogs, sloping bogs, and depressions where a great variety of sphagnum species occur in association with low ericaceous plants and sedges.

Although climate seems to be the defining characteristic limiting forest growth in this ecoregion, natural disturbances attributed to insects, windstorms and fire have played a role in shaping the forest ecosystems of the ecoregion. Ecologists with Parks Canada have suggested, based on GIS analysis of inventory data and field sampling, a fire origin for much of the Taiga Ecoregion. Human disturbance in the Taiga Ecoregion is fairly recent. Woodland caribou, which would have certainly used the area for summer grazing, were extirpated by hunting in the mid 1920s. In 1936, much of the area became part of the Cape Breton Highlands National Park. In the late 1970s water was diverted as the area surrounding the Cheticamp Lakes was flooded to establish a hydroelectric power generating station at Wreck Cove. There is no history of logging since the stunted trees of the ecoregion are of no commercial importance.

Ecosections	Area (ha)	% District	Cumulative %	Distinguishing Ecoregion Feature: *Elevations exceeding 450 m above sea level. Stunted trees, raised bogs, barrens and extreme weather conditions.*
WMKK	11162	25.1	25.1	
IMKK	10203	23.0	48.1	
WCHO	6333	14.3	62.4	
PMSM	4911	11.1	73.5	
IMRD	4676	10.5	84.0	
IMHO	2979	6.7	90.7	

200 - Cape Breton Highlands Ecoregion

The Cape Breton Highlands Ecoregion, which includes lowlands, steep slopes and plateau, extends from the waters of the Cabot Strait to the mountains east of Lake Ainslie. With the exception of the northern part of the ecoregion, which extends from sea level to the plateau, the elevation for most of the region is between 300 and 450 m. The plateau is gently undulating, while the walls of the escarpment are extremely steep (see insert). These steep slopes are relatively unstable, indicated by the prominent colluvial deposits of soils and rocks at their base. Narrow bands of Windsor Group rocks stretch from Cape Smokey south to Indian Brook at the base of the escarpment. Some of the oldest rocks in Nova Scotia occur here, dating back to the Precambrian period. Gneiss at Blair River has been dated at over one billion years. A dominant geological feature of this ecoregion is the Aspy Fault, which runs 40 km south-southwest into the interior of Cape Breton Island. More minor faults and sheers are fairly common with various orientations, commonly sub-parallel to the Aspy Fault. The soils are generally sandy loams, with coarser sands occurring on the eastern side of the ecoregion

where the till is thinner and there is more exposed bedrock. While the slopes are well drained with extremely high seepage potential, the plateau has large areas of imperfectly and poorly drained sites. The total area of the region is 3109 km^2 or 5.6 % of the province.

Slope Gradient (expressed as %)	% of Cape Breton Highlands Ecodistrict
Level (0-8)	3
Undulating (9-15)	68
Rolling (16-30)	14
Steep (31-60)	14
Very Steep (61+)	1

The Cape Breton Highlands, as a land mass, are not high enough to block the movement of air masses but their elevation is sufficient to wring additional moisture from passing weather systems and to cool temperatures by 1 or 2 degrees Celsius. Although the climate of the Cape Breton Highlands Ecoegion is similar it is not quite as harsh as that of the higher elevations of the Taiga Ecoegion. Fog is common and precipitation averages 1400 - 1600 mm annually, with about 400 cm of snow. With a more rolling landscape on the plateau, the effect of the wind is lessened. While the deeply incised valleys offer some protection from the winds, they also create long shadows and reduce direct sunlight to north facing slopes.

On the plateau, the forest is boreal in appearance and the dominant tree is balsam fir followed distantly by white spruce and white birch, with black spruce occurring in the wetter areas. Tolerant hardwoods prevail on the slopes, along with scattered conifers and other hardwoods. The ecoregion is home to many rare and local plants and rare animals including lynx, Gaspe shrew, and rock vole.

The dominant natural disturbance on the plateau is the spruce budworm. The recurring nature of infestations has done much to guide successional pathways and shape the fir-spruce forests of the Cape Breton Highlands. Balsam fir is the preferred food source, although white spruce is also susceptible. In parts of the Maritimes, outbreaks can be traced back more than 200 years. In Nova Scotia, early outbreaks are known only from Cape Breton Island. Known infestations occurred in 1846, 1891 and 1896. After the turn of the century there was an outbreak around 1916 that crossed the Strait of Canso. A less extensive outbreak occurred in the mid 1920s. In 1950, an outbreak occurred that lasted until 1957. In 1974 mature balsam fir forest conditions on the Island created an environment susceptible to a build up of the spruce budworm population, which eventually caused widespread mortality of the fir forest until the population crashed in 1985.

Distinguishing Ecoregion Feature: *Elevations 300-450 m above sea level. Mountainous terrain, cold winters with high snow cover, boreal forest, and moose.*

With the completion of the Cabot Trail in 1932 and the opening of the Cape Breton Highlands National Park in 1936, the area became accessible as a tourism destination. Today, thousands of people visit the park annually but the mountainous topography keeps much of the ecoregion in isolation.

Ecodistricts of the Cape Breton Highlands Ecoregion

210 - Cape Breton Highlands	*2985 km²*
220 - Victoria Lowlands	*125 km²*

210 - Cape Breton Highlands

The Cape Breton Highlands Ecodistrict includes the steep, generally well drained slopes which define the plateau that rises 300 - 450 m above sea level on northern Cape Breton Island. From a distance the top of the highlands looks perfectly flat, however, once on top of the plateau the topography becomes more evident. Underlain with old erosion resistant rocks, the plateau is gently rolling with knolls, small hills or hummocks, and gently sloping valleys. On the plateau, residuum and bedrock are partially covered with a thin discontinuous veneer of moderately coarse textured stony till, 1 - 4 m thick. Extensive areas of exposed bedrock occur in the ecosection and account for 6.5% of the ecodistrict or 19,100 hectares. The ecodistrict has cold, late springs and snow cover lasts into May. Despite the high elevation, the ecodistrict is not the coldest in the province. The average winter temperature is -4.2 C, compared to -6.1 C in the Northumberland Lowlands Ecodistrict (530). Heavy snowfalls of about 347 cm are typical and the Highlands are subjected to some of the highest winds in the province (Webb and Marshall, 1999). The ecodistrict covers 2985 km² or 96 % of the Cape Breton Highlands Ecoregion.

The soils of the Highlands have not been extensively surveyed aside from the few agricultural areas. Much of the area has had the soils categorized as "rough mountain land" and described as well drained, moderately coarse textured soils. The parent material is a thin veneer of moderately coarse textured stony till over bedrock, with variable permeability. On the east side of the plateau, north of Ingonish, on the well drained, coarse textured, knolls there are large areas of exposed bedrock (70%) where there are very few trees. However, the majority of the plateau is covered in a boreal fir spruce forest. The dominant species is balsam fir mixed with black spruce and scattered white spruce and white birch. Black spruce and eastern larch occupy the wetter areas with high populations of *Sphagnum* mosses and *Carex* species (sedges). Ringing the highlands are steep slopes forested with the tolerant hardwoods such as sugar maple, beech and yellow birch. Where these steep slopes meet the plateau of the highlands a forest of yellow birch and balsam fir will be found. On the lower

slopes, sugar maple, beech and yellow birch prevail, along with scattered red oak, white ash, white birch, red maple, hemlock and white pine. White pine and hemlock will be found in the ravines, especially on the east side of the highlands. In the broad valley intervals there are stands of hemlock, red oak, white ash and elm, along with other trees. On the east side, near Neil's Harbour, there are rare open stands of jack pine. The ecodistrict has also acted as a refuge for rare arctic-alpine and Cordilleran plants. No where is this more evident than at Corney Brook where one may find purple alpine saxifrage, yellow mountain saxifrage, *Diapensia lapponica*, small flowered wood rush, giant rattlesnake plantain, *Epilobium hornemannii*, and Northern bedstraw.

Ecosection	Rockland %	Area (ha)	% Ecodistrict	Cumulative %
WMKK	1.1	105958	35.5	35.5
WMDS	2.2	71844	24.1	59.6
WCKK	33.2	39318	13.2	72.8
WMHO	0.2	26537	8.9	81.7
IMHO	1.2	17539	5.9	87.6
WCDS	10.1	14913	5	92.6

Repeated attacks by the spruce budworm has been the major disturbance to the fir dominated forests of the Cape Breton Highlands Ecodistrict. The mortality caused by the budworm during the last outbreak in the late 1970s has led to the re-establishment of the balsam fir forest, much of which is being intensively managed in an effort to reduce the impact of the next outbreak on the wood supply. Along with budworm infestations, fire has also been a stand initiating disturbance. Ecologists at the Highlands National Park have reported that 20% of the park displays characteristics of fire origin (Bridgland et al). In the 1830s, settlement began as the mountains surrounding Middle River were cleared and farmed. By the late 1950s much of this farmland was abandoned and today areas such as Crowdis, Gairloch, and Gillanders Mountains have regenerated to old field white spruce.

220 - Victoria Lowlands

The Victoria Lowlands is the smallest mainland ecodistrict in Nova Scotia and includes several low-lying coastal areas on the north and east side of the Cape Breton Highlands. These areas are located on outwash plains, alluvial terraces and fans isolated due to their location between the highland escarpment and the Atlantic Ocean. The underlying rocks are shale, limestone and sandstone characteristic of the carboniferous lowlands. Where gypsum occurs there is karst topography with sinkholes. Along the coast, the sea is constantly eroding edges of the ecodistrict. The soils are well drained, moderately coarse textured on rolling plains with slopes of 2 - 30%. In areas where coarse sandy loams of the Hebert soil series occur, drainage can be rapid. The total area is 125 km^2 or 4% of the Cape Breton Highlands ecoregion.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WCHO*	7427	58.8	58.8
WFKK	2143	17	75.8
WMKK	604	4.8	80.6
WCKK	545	4.3	84.9
WMHO	475	3.8	88.7

*These ecosections have karst topography with sinkholes: 2,331 hectares have been identified.

At Ingonish, the annual precipitation averages 1676 mm, about 10% higher than any other weather station in Nova Scotia. The ecodistrict is also subjected to the same heavy snowfalls that occur on the steep slopes and plateau of the Highlands, with an average snowfall of 358 cm (Webb and Marshall, 1999). This ecodistrict contains most of the land suitable for farming in the northern part of Cape Breton and where old fields and clearings have been abandoned white spruce has reforested the sites.

300 - Nova Scotia Uplands Ecoregion

The Nova Scotia Uplands Ecoregion stretches from Cape Chignecto in Cumberland County to Kellys Mountain in Cape Breton. There are eight ecodistricts within this ecoregion, with elevations of 150 to 300 m on both the mainland and Cape Breton Island. The only exception is the Inverness Lowlands Ecodistrict (320), which is comprised of the valley floors of the rivers flowing from the uplands and highlands. It has been included in this ecoregion due to the influence of the surrounding uplands on the microclimate. The ecoregion is geologically diverse and complex with remnants of the Cretaceous peneplain surface, composed of metamorphic, intrusive and volcanic rocks of the Precambrian to Paleozoic eras. The lowlands

within this ecoregion are underlain by Paleozoic sedimentary rocks. Several major faults border or transect this ecoregion, most notably the Cobequid-Chedabucto Fault zone and the Hollow Fault. On the hills, the parent materials are generally sandy loams. Clay loams occur on the flats of southern Inverness County and loams are found on the Mulgrave plateau. Where the topography is gently rolling, the soils are usually well to moderately well-drained. Many of the slopes are steep with rapid to well-drained soils, but middle and lower slope positions have a significant potential for enrichment due to seepage. Extensive areas of smooth or level topography at the tops of these hills tend to have imperfectly to poorly drained soils, which support forests of coniferous species. The total area of the ecoregion is 9,862 km^2 or approximately 17.8% of the province.

Distinguishing Ecoregion Features:
Elevations 150 - 300 m above sea level. Warm summers and long cold winters, upland areas.

The hilly topography of the uplands creates microclimatic environments where sheltered and exposed conditions can vary the local weather, especially temperatures. Overall, summers tend to be warm and winters are long and cold. Average precipitation is between 1200 - 1500 mm, with 250 - 350 cm of snow. The greatest snowfall occurs on the Cobequid Hills and Cape Breton Hills. Wind and ice damage are significant limiting factors to tree growth, especially for the hardwoods on the crests and upper slopes, resulting in stunted forests of beech and sugar maple.

On the hardwood hills, sugar maple, beech, red maple and yellow birch pre-dominate. White spruce, red spruce, and balsam fir form mixedwoods with the above hardwoods on some valleys and slopes. Hemlock is commonly found in ravines. On the hummocky terrain of the Mulgrave Plateau, St. Mary's River and Central Uplands, red spruce, balsam fir, white pine and hemlock are common on the well-drained soils. Occasionally these tolerant softwoods mix with the tolerant hardwoods to create diverse mixedwoods, especially on the lower slopes where seepage has enriched the soils with nutrients and moisture. Black spruce and eastern larch occur on the imperfect and poorly drained soils. There are also large areas of barrens caused by repeated burning where bracken fern and sheep laurel are dominant. The river valleys were quickly cleared of forest cover by the European settlers in the 1700s and 1800s. These original forests of white ash, sugar maple, American elm and balsam poplar (Stanley, 1970) are now uncommon. The settlers also cleared much of the upland areas for fields and pastures, but with increased urbanization after the Second World War this abandoned farmland has been recolonized by white spruce.

In the hardwood forests of the uplands, mortality is usually confined to individual trees or species and may be due to insects, disease, blowdown, old age, or physical damage due to wind,

snow, ice or lightning. These types of mortality are called gap or patch disturbances and create uneven-aged stands. In the softwood forests, which occur on the level plateaus of the uplands or in the lowlands of the river valleys, fire, insect and blowdown act as the natural disturbance and may create large areas of destroyed forests. This type of natural disturbance is called a stand-initiating event. The interval for such disturbances is generally more frequent than the average longevity of the climax species and results in even-aged forests.

Ecodistricts of the Nova Scotia Uplands Ecoregions

310 - Cape Breton Hills	*2542 km²*	*350 - Cobequid Slopes*	*313 km²*
320 - Inverness Lowlands	*483 km²*	*360 - Mulgrave Plateau*	*896 km²*
330 - Pictou Antigonish Highlands	*1310 km²*	*370 - St. Mary's River*	*852 km²*
340 - Cobequid Hills	*2137 km²*	*380 - Central Uplands*	*1329 km²*

310 - Cape Breton Hills Ecodistrict

Most elevations in the Cape Breton Hills Ecodistrict fall between 150 - 300 m above sea level. This includes the more recognizable hills of Kelly's Mountain, Cape Mabou, Cregnish Hills, North Mountain, Boisdale Hills, Sporting Mountain, East Bay Hills, Whycocomagh and Lewis Mountain. Also falling into this district are several lower elevation hills, including Mount Young, Washabuck/Cains Mountains, Southwest Mabou Ridge, Beinn Bhreagh and Rear Forks Baddeck. The ecodistrict is influenced by the strong, cold winds of the Gulf of St. Lawrence. Temperatures are slow to warm in the spring resulting in a short growing season. The area receives between 1400 - 1550 mm of precipitation annually. The total area is 2542 km² or 26% of the Nova Scotia Uplands Ecoregion.

The higher steep-sloped hills are underlain with older resistant rocks and are covered with well drained, moderately coarse textured tills. In general, the lower more gradually sloping hills are underlain by coarse carboniferous sediments. The soils tend to be imperfectly drained, fine textured tills. Seepage sites are common on the slopes providing some of the richer sites for tree and plant growth. Areas of karst topography are found throughout the district at lower elevations, most notably on the Iona peninsula and at Marble

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMKK	82114	32.3	32.3
WMDS	57451	22.6	54.9
WFKK	34477	13.6	68.5
IMHO	32245	12.7	81.2
WMHO	17932	7.1	88.2
IFHO	7828	3.1	91.3

Mountain and near Mabou, Port Hood/Judique and Inverness. Freshwater accounts for 0.4% or 1,032 hectares of the ecodistrict.

This ecodistrict is predominately a tolerant hardwood forest with scattered spruce and fir. In coastal areas, white spruce is more frequent. On ravines with well drained, medium textured soils eastern hemlock, white pine and scattered red spruce are found. On top of the larger hill complexes, level to hummocky topography underlain with imperfectly drained soils yield stands of black spruce and balsam fir. Yellow birch , sugar maple and red maple grow on the better drained soils. Much of the early land grants on the upland sites were cleared for farming, but once abandoned in the early to mid 1900s the fields and pastures reverted to pure stands of white spruce.

320 - Inverness Lowlands Ecodistrict

This is one of the smallest ecodistricts in the province, stretching from Cheticamp in the north to Mull River and Whycocomagh Bay in the south. It includes the fault valleys of both the Margaree and the Middle Rivers. The total area is 483 km^2 or 5 % of the Nova Scotia Uplands Ecoregion. The area tends to be somewhat sheltered by the surrounding uplands (Cape Breton Hills - 320, Cape Breton Highlands - 210), with the exception of the Cheticamp area where a combination of topography and temperature create a unique phenomenon, locally known as "*les suetes*". A *suete* begins with winds blowing in off the Atlantic Ocean. When conditions are right, the swirling air molecules slide up the eastern slope of the Cape Breton Highlands, then begin the steep downward descent on the western side, gathering speed as they go. The strongest one recorded, which struck on March 13, 1993, was officially clocked at 233 km/hour. The Margaree Valley is known for having some of the coldest temperatures and the shortest recorded frost-free period in the province.

The underlying geology is comprised of carboniferous, clastic sediments, gypsum and limestone. The terrain is gently undulating to rolling. Lake Ainslie and the Margaree River account for a large proportion of the freshwater in the ecodistrict (13.9% or 6700 hectares). Another significant portion of the ecodistrict is comprised of freshwater wetlands (3.9%) and salt marshes and coastal beaches (0.75%).

The first Europeans came to the area in the 1750s to establish fishing stations along the coast. Actual settlement began about 30 years later, with French emigrants settling at Cheticamp and United Empire Loyalists coming to Mabou. The terrain is comprised of gently undulating to rolling low-lying areas and is suitable for farming. Coal and gypsum have been mined at several

locations. Due to heavy settlement in this area, most of the original forest has been severely disturbed, especially on the interval lands which account for almost 10% of the ecodistrict. On these interval lands sugar maple, white ash, balsam poplar and American elm formed the climax forest (Stanley, 1968). Extensive areas of black spruce forest are found on the moist soils of this ecodistrict.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WCHO*	7443	15.4	15.4
IFHO	6769	14.0	29.4
IMHO*	4980	10.3	39.7
WFHO*	4141	8.6	48.3
WMHO*	3913	8.1	56.4
IMSM*	2935	6.1	62.4
WMKK*	2356	4.9	67.3
WCKK	1678	3.5	70.8
ICSM	1636	3.4	71.2

*These ecosections have karst topography with sinkholes; 6,072 hectares have been identified on these and other ecosections within the ecodistrict.

330 - Pictou Antigonish Highlands Ecodistrict

This ecodistrict has been described by Roland (1982) as an elevated triangle of resistant strata separating the Northumberland lowlands of Pictou County (530) from the lowlands of St.George's Bay (520). The highlands abut the St. Mary's fault block to the south along the Chedabucto fault where the East River St. Mary's flows. This upland ecodistrict is crosscut by subsidiary faults trending north-south and northeast-southwest, creating many narrow valleys. The most notable fault is the Hollow Fault, which extends from Cape George to New Glasgow. The fault is marked by the 200 m scarp which has developed as a result of differential erosion. The total area of this ecodistrict is 1,310 km^2 or 13% of the ecoregion.

Roland (1982) and Davis and Browne (1986) describe the geology of this ecodistrict as being extremely complex. The rocks display strong metamorphism, folding and distortion. The underlying bedrock consists of Precambrian to Paleozoic sediments and volcanics, strongly deformed and metamorphosed, and intruded by pre-carboniferous granitic to gabbroic plutons. Much of the province's geological history can be viewed in this ecodistrict including ancient volcanoes and the 400-million-year-old fossils at Arisaig. The elevation is generally 210-245 m above sea level and rises to

300 m at Eigg Mountain. Overall, the highlands summit to a rolling plateau best exemplified by The Keppoch, an area once extensively settled. The dominant soils are mostly sandy loams which are well drained and fairly stony. Other dominant soils include those derived from shales. Typical of the upland ecodistricts, freshwater accounts for only 0.54% or 702 hectares.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WCKK	52072	39.7	39.7
WCHO	30202	23.1	52.8
WFKK	14148	10.8	62.9
ICHO	9784	7.5	70.3
IMHO	7582	5.8	76.1
WCDS	6163	4.7	80.8

The tolerant hardwood forests are especially notable on the crests and upper slopes of hills and larger hummocks. Otherwise, red spruce and hemlock are found on the lower slopes with black spruce occupying the imperfectly drained sites. Mixedwood, tolerant forests of beech, sugar maple, yellow birch and red spruce with scattered hemlock grow on the steep slopes adjacent to the streams and rivers which flow from the highlands. On the coarse textured soils derived from glacial outwash, usually found along the streams and rivers, pure stands of white pine will be found. Many of the old field, white spruce stands occupy ecosections previously forested with upland hardwoods. Good examples of this occur at Rossfield and The Keppoch.

340 - Cobequid Hills Ecodistrict

Webb and Marshall (1999) describe the 150 km long Cobequid Mountains as a cigar-shaped block running just west of Pictou to Cape Chignecto. These hills separate the two lowland ecodistricts, the Minas Lowlands (620) to the south and the Northumberland Lowlands (530) to the north. The highest points on the mainland are found on the Cobequids at Nuttby Mountain and Dalhousie Mountain which rise to 335 m above sea level. As Roland (1982) noted, the Cobequids from a distance give an appearance of a more irregular skyline than other uplands, an appearance he credits due to the narrowness of the upland surface. Of the ecodistricts within the Nova Scotia Upland Ecoregion (300), the Cobequids are the driest with only 1182 mm of precipitation per year. However, they receive the greatest snowfall on the mainland with over 300 cm of snow in an average year. The total area of the ecodistrict is 2,137 km^2 or 22% of the ecoregion.

The geological history of the Cobequids is complex. Most of the strata are pre-carboniferous and are resistant to erosion. Many faults are expressed throughout the Cobequids, with the most prominent, the Cobequid fault, on the south extending from Truro to Cape

Chignecto. Freshwater lakes and streams account for only 0.47% of the ecodistrict (1,005 hectares). Many of the lakes are small and shallow, but Folly Lake, which appears to have resulted from glacial ice resting in the valley of an old river and choking both ends with gravel deposits from the melting ice, is 80 hectares in size and over 100 m deep. The Cobequids provide a watershed for streams running north or south which leave the mountains in deep, steep-walled gorges as a series of falls or cascades. The soils of the Cobequids are dominated by coarse gravelly to stony sandy loams derived from igneous and metamorphic rocks. In many areas, the soils are shallow to bedrock, especially on the well drained, coarse textured soils found on hilly topography (WCKK).

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WCKK	123660	57.9	57.9
WCHO	28740	13.5	61.5
ICHO	22927	10.7	72.2
WCDS	15019	7.0	79.3
WMKK	6822	3.2	82.5
ICSM	4008	1.9	84.3
WMDS	3771	1.8	86.1

The Cobequids support pure stands of tolerant hardwoods extending from the crests to lower slopes of hills and large hummocks. In between these hills, extensive flats of imperfectly drained coarse textured soils on the level to hummocky terrain (ICSM and ICHO) are found where forests of red spruce and black spruce dominate. Another characteristic of the ecodistrict are the steep-sided ravines with well drained coarse to medium textured soils where forests of shade tolerant species including hemlock, white pine, white ash and ironwood can be found. The growth potential of the hardwood forests is seriously limited on the upper elevations where damage caused by snow and ice breakage reduces height and stem quality. However, on the sheltered lower slopes, hardwood potential is improved as the exposure to winds is diminished. Many stands of white spruce can be found in the ecodistrict, again on the abandoned farmland of the early settlers who must have found the environment a serious impediment to crop production.

350 - Cobequid Slopes Ecodistrict

Best described as the foothills of the Cobequids (340), the rolling topography of this ecodistrict eventually levels into the Minas Lowlands Ecodistrict (620). 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 who venture down from the higher elevations as snow accumulations restrict movement. The total area of this ecodistrict is 313 km^2 or 3% of the ecoregion.

The Cobequid Fault provides the northern boundary of this ecodistrict and separates the older more resistant pre-carboniferous rocks of the Cobequids (340) from the late carboniferous siltstone, shale and conglomerate. The Portapique Fault forms the southern boundary, separating the slopes from the Triassic siltstone and sandstone of the Minas Lowlands (620). This ecodistrict has an array of soils ranging from the very coarse, sandy loams associated with outwash to the clay loams. All of the freshwater within this ecodistrict, 0.4% of the area, is located in the streams and rivers flowing through on their way to the Minas Basin.

Ecosection	Area (ha)	Ecodistrict%	Cumulative %
WCKK	7020	22.5	22.5
IMHO	6868	22.0	47.5
IFKK	5857	18.7	66.2
WMKK	3248	10.4	76.6
WMHO	2198	7.0	83.7
IMRD	2136	6.8	90.5

The forests of the Cobequid Slopes Ecodistrict can best be described as tolerant mixedwood 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 occur. For the most part, white pine is absent from the ecodistrict. Hemlock occurs on the steeper slopes along streams and rivers.

360 - Mulgrave Plateau Ecodistrict

The part of the Mulgrave Plateau north of the fault-controlled Roman Valley is underlain by strongly folded sedimentary rocks of the Horton Group. The area between Roman Valley and the Chedabucto Fault is underlain by the Guysborough Group, consisting of sedimentary and volcanic rocks. Both plateau portions are comprised of extensive areas of imperfectly drained level to hummocky topography. The steep slopes of these elevated plateaus, approximately 200m above sea level, are well drained and support a mixture of tolerant hardwoods and softwoods. The total area

of the Mulgrave Plateau ecodistrict is 896 km^2 or 9% of the ecoregion. The Roman Valley River flows towards Chedabucto Bay via the Milford Haven River which, along with Guysborough Harbour, is an example of a drowned estuary (the mouth of a river submerged due to a rise in sea level).

The eastern portion of the ecodistrict is appreciably wetter than the western portion and is drained by the St. Francis Harbour River which flows out of Goose Harbour Lake which has been dammed for use as an industrial water supply in Port Hawkesbury. Two other lakes, Grant and Summers, have also been dammed for water supply for Mulgrave, while another reservoir has been created at Melford Lake for future industrial use. However, only 3.3 % of the ecodistrict is covered in fresh water (2,955 hectares). Low relief drumlins dot the eastern portion of the ecodistrict around Goose Harbour Lake. The soils of the ecodistrict are mostly well drained, gravelly sandy loams except for the eastern portion which is imperfectly drained. Clay loams on the drumlinized till plain are also imperfectly drained.

The ecodistrict is bordered by the waters of the Northumberland Strait and the Strait of Canso with both areas prone to strong coastal winds. The forests on the well drained, coarse textured hills (WCKK) that border this water are similar to the coastal forests of the Atlantic Coastal Ecoregion (800). An association of red maple and yellow birch dominate the drumlins (WMDM) with scattered sugar maple on the lower slopes. Red spruce and hemlock are more prevalent in the sheltered ravines and along streams and steep slopes of the WCKK ecosections. The forest is mostly black spruce and red maple on the wetter soils, with tolerant hardwoods, red spruce and white pine on the better drained soils found on the hills and steeper hummocks. Balsam fir usually regenerates on the better drained land and much of the area is used for Christmas tree production.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMKK	38252	42.7	42.7
IMHO	20540	22.9	65.6
WMHO	9923	11.1	76.7
WMDM	3986	4.5	81.2
WFHO	2634	2.9	84.1
WFKK	2122	2.4	86.5
IFHO	1994	2.2	88.7

370 - St. Mary's River Ecodistrict

The physical boundaries of this ecodistrict are easily recognized, both on the ground and from aerial photography, due to the prominence of the two parallel faults that resulted in a graben (a downfaulted block lying between two faults) and the subsequent escarpments that delineate the ecodistrict. The East River St. Mary's parallels the Chedabucto Fault from Eden Lake to Melrose. The West River St. Mary's gathers its headwaters near Trafalgar and flows east along the St. Mary's Fault to Melrose to the confluence of the two rivers which then flow south to the Atlantic Ocean. The total area of the ecodistrict is 852 km^2 or 8.5% of the ecoregion.

The ecodistrict is underlain by siltstones and sandstones of the Horton Group. For the most part the topographic pattern of the ecodistrict is hummocky. Wetlands and drumlins are associated with the level terrain. Most of the soils are well drained, stony to gravelly sandy loams developed on till veneers of the Horton sandstones and shales. Freshwater totals 4.0% of the ecodistrict or 3,439 hectares.

Ecosection	Area (ha)	Ecodistrict%	Cumulative %
WMHO	24428	28.7	28.7
IMHO	16340	19.2	47.8
WMDM	14924	17.5	65.4
WMKK	10746	12.6	78.2
WFHO	3442	4.0	82.2
WFDM	3068	3.6	85.8
IMSM	2404	2.8	88.6
PMSM	1982	2.3	91.0

The shallow coarse soils, for the most part, support forests of black spruce and white pine. The better forests of red spruce and tolerant hardwoods will be found on the drumlins and upper slopes of the hills. Historically, repeated burnings have resulted in extensive barrens in the ecodistrict, for example, Eden Barrens and Barren Brook. Fires on the shallow, sandy soils may also have reduced the fertility of the soils and their ability to produce stands of better productivity contributing to the abundance of fire species such as the black spruce. Smith (1857) in his travels along the east and west St. Mary's rivers often remarked on the abundance of sugar maple as well as American elm and black cherry on the intervals. He entered in his journal that "above the lakes [Glenelg] for two miles there is an interval from one half to three quarters of a mile broad, very low and often flooded. The timber of a large size, chiefly sugar maple, elm and yellow birch and some oak".

380 - Central Uplands Ecodistrict

Referred to by Roland (1982) as the Horton Highlands, this upland extension of the St. Mary's fault block has some of the more productive red spruce forests in Nova Scotia. Partially wedged between the Cobequid Hills (340) to the north and the Pictou Antigonish Highlands (330) to the east, this ecodistrict occupies the gently rolling uplands of central Nova Scotia. Sloping easterly upwards from the St. Mary's River Ecodistrict (370), elevations average 300 m above sea level. This area contains the headwaters of the Stewiacke and Calvary Rivers, which eventually make their way to Cobequid Bay. The total area of the ecodistrict is 1,329 km^2 or 13.5% of the ecoregion.

The geology is somewhat similar to that of the St. Mary's River (370) and Cobequid Slopes (350) Ecodistricts. Soils are predominantly well drained to moderately well drained with mottling, an indication of restricted drainage during the growing season, present in many of the finer textured soils. First, second and third order streams with a trellised drainage pattern and a few small. Shallow lakes cover only 0.75% of the ecodistrict.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
IMHO	29466	22.2	22.2
WMKK	22532	17.0	39.1
IFKK	20824	15.7	54.8
WMHO	16994	12.8	67.8
WFKK	11274	8.5	76.3
IFHO	8659	6.5	82.8
IMRD	4159	3.1	85.9
WFHO	3236	2.4	88.4

Red spruce is the dominant forest species in the ecodistrict and occupies many of the moist sites, which in other ecodistricts would be covered by black spruce. Pure stands of tolerant hardwoods are present on the crests and upper slopes of hills and steeper hummocks (WMKK, WFKK, IFHO). Red spruce, yellow birch and sugar maple will form mixed stands on the finer textured soils, but following harvesting may revert to pure stands of red spruce. Hemlock prefers the sheltered moist sites of lower slopes along streams and rivers and white pine is scattered on the better drained, coarse textured soils.

400 - Eastern Ecoregion

Extending from Bedford Basin to the town of Guysborough, this ecoregion is the eastern extension of the Appalachian peneplain which slopes towards the Atlantic Ocean (see also Western Ecoregion 700). It is bordered to the south by the Atlantic Coastal Ecoregion (800) and to the north by the St. Mary's Fault. The highest points of elevation, 220 m above sea level, are found in the Governor Lake Ecodistrict (450). The ecoregion is underlain by quartzite and slate of the Meguma

Group, with granitic intrusives. Webb and Marshall (1999) describe the variety of landforms in this ecoregion, which includes rolling till plains, drumlin fields, extensive rockland, and wetlands. The ecoregion has been divided into five ecodistricts, of which two are comprised of disjunct areas. The Rawdon/Wittenburg Hills (410) are two individual slate ridges separated by the Shubenacadie River and about 20 km. The Eastern Drumlins (420) concentrate in three disjunct areas identified by the Sackville, Tangier and Moser Rivers which flow through them. The total area of the ecoregion is 6,350 km^2 or 11.5% of the province. Removed from the immediate climatic influence of the Atlantic Ocean, the ecoregion is characterized by warmer summers and cooler winters. The mean winter temperature is colder (-5.0 C) than the Western Ecoregion where the mean winter temperature is -3.5 C (Webb and Marshall 1999).

Distinguishing Ecoregion Features:
South sloping upland interior in eastern Nova Scotia with warm summers and cooler winters.

The forests of the ecoregion are predominantly coniferous, with red and black spruce occupying the majority of sites. Scattered stands of hemlock are found in the sheltered and moist environments of narrow stream and river valleys and on the slopes of drumlins. Stands of white pine are found on the deep, well drained coarser soils associated with outwash till. Also, white pine is usually scattered or a minor component of black spruce forests, especially on the fire barrens. Tolerant hardwood forests dominated by yellow birch and sugar maple, with scattered beech are usually found on the drumlins and upper slopes and crests of steeper hills. The dominant natural disturbances are fire and hurricanes. The coarse textured soils associated with the granitic ecodistricts, Eastern Granite Uplands (430) and Governor Lake (450), are subject to moisture deficit during the summer months and prone to fires caused by lightning. Hurricanes originating in the Caribbean and traveling along the eastern seaboard have frequently destroyed large areas of mature forests in this ecoregion, particularly in the Eastern (440) and Eastern Drumlin ecodistricts (420).

Ecodistricts of the Eastern Ecoregions

410 - Rawdon\Wittenburg Hills	*576 km^2*
420 - Eastern Drumlins	*847 km^2*
430 - Eastern Granite Uplands	*602 km^2*
440 - Eastern Interior	*3693 km^2*
450 - Governor Lake	*634 km^2*

410 - Rawdon\Wittenburg Hills Ecodistrict

These two slate ridges rise notably above the surrounding valleys of the Stewiacke, Musquodoboit and Shubenacadie rivers in central Nova Scotia. With elevations of 180-210 m, the Rawdon Hills and Wittenburg Mountain contrast with these carboniferous lowlands (Central Lowlands 630). Climatically, temperatures are cooler, especially in winter, and considerably more moist than the adjacent lowlands. The total area of this ecodistrict is 576 km^2 or 9% of the ecoregion.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMKK	32520	56.4	56.4
IMHO	11210	19.4	75.8
IFKK	8910	15.5	91.3
WMHO	2312	4.0	95.3

The deeply dissected northeast trending ridges are comprised of folded Meguma Group slate. Even small streams along their margins occupy deep indentations. Sandy clay loams and clay loams occur on the side slopes of these ridges. On top of the ridges, well drained soils of sandy loams and loams derived from shales and slates will be found. Wittenburg Ridge, divides the St.Andrews River and the South Branch of the Stewiacke River from the Musquodoboit River. The Rawdon Hills, are crosscut by the Herbert and Meander rivers and several major brooks, all of which have valley and interval ecosections. The Nine Mile River also drains the Rawdon Hills. In total, freshwater only accounts for 0.4% or 250 hectares of the ecodistrict.

Red spruce forests are very common on both of these slate ridges, occurring predominantly on the hummocky terrain. However, a significant feature of this ecodistrict is the occurrence of mixedwood forests, especially on hilly topography underlain by moist, fine textured soils. On these ecosections, pure stands of either tolerant softwood or hardwood may occur or combine to form a classic mix of the sugar maple, yellow birch, beech, white ash, red spruce and hemlock with scattered white pine indicative of the Acadian ecozone.

420 - Eastern Drumlins Ecodistrict

This ecodistrict is comprised of three disjunct areas of drumlins within the eastern ecoregion and can be identified roughly by the watersheds of the three rivers that flow through them: Sackville River, Tangier River, and Moser River. Although drumlins are scattered elsewhere in the eastern ecoregion, these three areas represent the highest concentrations. Formed by glacial ice movement the drumlins in this ecodistrict are orientated north-south indicating the route of the glaciers toward the Atlantic Ocean. The total area of the ecodistrict is 847 km^2 or 13% of the ecoregion.

The eastern drumlin fields are underlain by Meguma Group greywacke and slate, blanketed by fine-textured tills derived from these underlying and adjacent rocks. The drumlins are derived from carboniferous rocks from the north as well as material from the Cobequid Hills and Pictou-Antigonish Highlands. This imparts a "red" hue to the soils compared to the "grey" drumlins derived from slates common in western Nova Scotia. The soils are predominantly fine textured loams over sandy clay loams. The ecodistrict is dotted with a significant number of freshwater lakes, for a total of 6.2% of the ecodistrict or 5,245 hectares.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
IMHO	23654	27.9	27.9
WFDM	18122	21.4	49.3
WMDM	11387	13.4	62.7
WMHO	6641	7.8	70.5
IMRD	6618	7.8	78.3
IMSM	4758	5.6	84.9
WMKK	2587	3.1	87.0

In this ecodistrict, the well drained drumlins and hummocks provide an opportunity for pure stands of tolerant hardwoods, such as yellow birch, sugar maple and beech, to thrive on the crests and upper slopes. On the lower slopes, pure stands of red spruce will ring around the drumlins. Between drumlins black spruce occupy the wetter, imperfectly drained soils. White pine will occur on sites with dry, coarse, shallow soils such as those that occur on ridged ecosections.

430 - Eastern Granite Uplands Ecodistrict

Stretching in a narrow ridge (80 km long by 8-10 km wide) just east of Waverley to Sheet Harbour this ecodistrict lies north of the coastal Eastern Shore (820) Ecodistrict. Rising sharply up to 100 m above the adjacent coastal area, often with steep cliffs, this rocky ridge is dissected with narrow river gorges, the most notable being the Musquodoboit. Also of note are long narrow lakes that dissect the ecodistrict, such as Lake Charlotte and Porters Lake. The total area of this ecodistrict is 602 km^2 or 9.5% of the ecoregion.

The granite that underlies this ecodistrict is similar to the granite of the South Mountain Ecodistrict (720) and other outcrops throughout the western (700) and eastern (400) ecoregions. Granite is very resistant to erosion and most of the soils associated with this granite are coarse

textured and shallow. Many ecosections in this ecodistrict have exposed bedrock and are scattered with huge, sometimes house-size granite boulders deposited by the glaciers. It is estimated that approximately 15% or 9000 hectares of the ecodistrict is exposed bedrock. This ecodistrict also has one of the highest concentrations of freshwater lakes with 11.1% coverage or 6682 hectares.

Ecosection	Rockland (%)	Area (ha)	% Ecodistrict	Cumulative %
WCKK	10.2	15999	26.6	26.6
ICHO	4.2	9780	16.2	43.8
WCRD	39.4	8512	14.1	57.9
ICKK	30	6772	11.2	69.1
ICRD	21	4261	7.1	76.2
WCHO	17.2	3927	6.5	82.7
IMHO	0	1806	3.0	85.7
WCDM	11.2	705	1.2	86.9

The forests of this ecodistrict are predominantly softwood, with red spruce stands on the better drained and deeper soils associated with hummocky terrain. Elsewhere, the shallow soils give rise to scrubby forests of black spruce and white pine with scattered red pine indicating fire disturbances in the past. Jack pine are also found on the shallow soils of ridge tops. Only on the few scattered drumlins will any tolerant hardwoods be found. Stands of hemlock occur on the steep sided slopes of hills and hummocks alongside rivers and streams.

440 - Eastern Interior Ecodistrict

One of the largest ecodistricts in the province with 3,693 km^2 or 58% of the ecodistrict, occupies an area from Pockwock Lake in the west to the Town of Guysborough in the east. The bedrock is highly visible in those areas where the glacial till is very thin, exposing the ridge topography. Where the till is thicker, the ridged topography is masked and thick softwood forests occur. The ecodistrict is heavily covered with freshwater lakes (27,312 hectares or 7.4%). The complexity of the ecodistrict is reflected in the abundance of ecosections due to the glacial history and movement of materials from northerly ecoregions. The eight largest ecosections (excluding water) make up 80.9% of the ecodistrict with the next eight making up 10.3%.

The ecodistrict is underlain by resistant Meguma Group quartzite and slate. The thickness of the till is quite variable across the ecodistrict, ranging from 1 - 10 m but averaging less than 3 m. Almost 9.3% of the ecodistrict (approximately 343 km^2) has been scraped clean by glaciers exposing large areas of bedrock. This situation can be found on ridged ecosections

(IMRD, WMRD) and coarse textured hills (WCKK) near Seloam Lake and the Head Lakes in the Liscombe Game Sanctuary. This situation has also been exacerbated by repeated fires. The predominant soils are sandy loams, often quite stony and well drained on till derived from quartzites. There are a few drumlins and hills scattered throughout the ecodistrict with fine textured soils derived from slates.

Ecosection	Rockland %	Area (ha)	Ecodistrict %	Cumulative %
WMKK	5.1	81452	22.1	22.1
IMHO	6.2	80024	21.7	43.8
IMRD	28.5	55439	15.0	58.8
WMHO	5.1	31211	8.4	67.2
WMRD	23.7	17756	4.8	72.0
PMSM	0	13060	3.5	75.5
WFKK	0	10485	2.8	78.3
WFDM	0.1	9423	2.6	80.9
IMSM	17	6414	1.7	82.6
WMDM	0	6109	1.7	84.3
WFHO	0	5644	1.5	85.8
ICHO	15.4	5557	1.5	87.3
IFHO	0.7	4664	1.3	88.6
WCKK	23.9	4483	1.2	89.8

The composition of the forests in this ecodistrict strongly reflect the depth of the soil profile. Thus, many climax compositions can be found throughout. On the shallow soils repeated fires have reduced forest cover to scrub hardwoods such as red maple and white birch, with scattered white pine and black spruce underlain by a dense layer of ericaceous vegetation. However, on the deeper, well drained soils stands of red spruce will be found. On the crests and upper slopes of hills, drumlins and some hummocks stands of tolerant hardwood occur. Both beech and hemlock occur on these deeper, well drained soils, but their presence is usually individual and seldom of a high percentage in any stand. On the imperfectly and poorly drained soils, black spruce will dominate the stand composition.

450 - Governor Lake Ecodistrict

Located in the centre of the eastern mainland, the Governor Lake Ecodistrict is characterized as an upland of granitic rock. To the north, the ecodistrict drops sharply to the West River St. Mary's but on the other three sides it is less abrupt in its rise above the shales and quartzites of the Eastern Interior Ecodistrict (440). At its highest point, the ecodistrict is 200 m above sea level. It occupies an area of approximately 634 km^2 or 10% of the ecodistrict. The ecodistrict has both the hottest summer temperatures and the coldest winter temperatures in the ecoregion. Along with the Margaree Valley, it has the shortest frost free period, less than 90 days. On an annual basis, the ecodistrict receives 1300-1400 mm of precipitation which is similar for most of the eastern and western ecoregions.

The ecodistrict is underlain by intruding Meguma Group granite similar to that found in the South Mountain (720) and Eastern Granite Uplands (430) and it is resistant to erosion. The terrain is thinly covered by coarse granitic till with many large granite boulders. Some glacial activity has created drumlins and eskers, which can be found scattered throughout the ecodistrict. The ecodistrict's geology can best be seen after a disturbance such as fire or clearcut harvesting has removed the vegetation and exposed the boulder strewn landscape. Approximately 2% of the ecodistrict has exposed bedrock, much of which is found in WCHO and WCKK ecosections around the Rocky Lake chain in the Liscomb Game Sanctuary. Much of the ecodistrict, 5.8%, is covered with lakes and streams (i.e. Ten-, Twelve-, Fifteen-, and Seventeen Mile) which merge to form the East River Sheet Harbour. The soils are coarse textured, well drained, gravelly sandy loams.

Ecosection	Rockland %	Area (ha)	Ecodistrict %	Cumulative %
IMHO	0.2	16469	26.0	26.0
WCKK	2.3	10758	17.0	43.0
WMKK	0	9804	15.5	58.5
ICHO	0.4	7127	11.2	69.7
WMHO	0	6841	10.8	80.5
WCHO	25.7	1759	2.8	83.3
PMSM	0	1147	1.8	85.1
WFDM	0	1102	1.7	86.8
WMDM	0	1099	1.7	88.5
WFKK	0	982	1.6	90.1

On the well drained upper slopes and crests of hills and drumlins, tolerant hardwood forests with sugar maple, beech and yellow birch of impressive diameter are found. Elsewhere, softwood forests dominate the ecodistrict with stands of red spruce and scattered hemlock. Isolated pockets of white pine will be found on the coarse shallow soils of ridges associated with black spruce and ericaceous vegetation. The ecodistrict is prone to wildfire due to the dryness of the soils and to windthrow due to the shallowness of the soils.

500 - Northumberland Bras d'Or Lowlands Ecoregion

Following the Northumberland Shore from the New Brunswick border to Port Hastings and bordering the shores of the Bras d'Or Lakes through to the Sydney coalfield, this lowland ecoregion occupies a significant area in eastern and northern Nova Scotia. This ecoregion includes the rolling hills of Antigonish County, where elevations exceeding 150 m above sea level are common. However, the majority of the ecoregion is relatively low lying, with a range of elevations between 25-50 m above sea level common along the Northumberland Strait and the Bras d'Or Lakes. The ecoregion is underlain by readily erodable Carboniferous sandstone, shale, limestone and gypsum. Where bedrock is Windsor Group limestone and gypsum, karst topography is common and sinkholes constitute a geo-hazard on some ecosections. The soils of the ecoregion range from well drained, moderately coarse to medium textured alluviums (sandy loams) common near Oxford, Pictou and Heatherton to the fine textured glacial tills (sandy clay loams) that predominate along the Bras d'Or Lakes and in northern Cumberland County. As well, large areas of imperfectly to poorly drained, moderately coarse to medium textured soils are common in the ecoregion. The soil drainage on these sites has been restricted due to a compacted basal till. The total area of the Northumberland Bras d'Or Lowlands is 7753 km^2 or 14% of the province.

Distinguishing Ecoregion Feature: *Sheltered lowland in northern Nova Scotia with a climate moderated by proximity to warm bodies of salt water.*

Climatically, this ecoregion is quite variable. The Northumberland Shore experiences some of the province's warmer summer temperatures and overall, is one of the cooler areas in winter. The waters of the Northumberland Strait warm considerably in late August, with a maximum surface temperature of 18 degrees Celsius which is enough contrast between air and water temperatures to cause on-shore sea breezes and to hold back the onset of frost for a few weeks. However, the eventual freezing over of the Strait effectively cuts off any marine influence for the next few months of winter. The Bras d'Or lowlands also experience rather cool winters, while summer temperatures are considerably cooler than those along the Strait. The mean annual precipitation ranges between 1100-1400 mm, with drier areas being along the Northumberland Strait. Despite the variability in climate, the ecoregion benefits from its proximity to the warmer salt water of the Northumberland Strait and the Bras d'Or Lakes

compared to ecoregions near the colder waters of the Atlantic and Bay of Fundy. The inland ecodistricts, Chignecto Ridges (560) and Cumberland Hills (540), have a climate somewhat transitional between that of the lowland ecodistricts and the ecodistricts of the Upland Ecoregion (300).

Because of the large areas of imperfectly drained soils, black spruce forests can be found throughout the ecoregion. A dry, warm summer climate contributes to a soil moisture deficit in parts of the ecoregion underlain by coarse textured soils. Fire adapted species, such as jack pine and black spruce, can be found here, especially in the ecosections near Oxford and Thomson Station, Cumberland County. On the hillier topography, where slopes improve the drainage, tolerant hardwoods will be found, for example, on Leicester Ridge, mixedwood stands of red spruce, hemlock, sugar maple, yellow birch and beech occur. Pure stands of red spruce are also common in Cumberland County, on the better drained soils and sites. Along the Bras d'Or Lakes, black spruce covers the lowland sites and tolerant hardwoods are found where the Cape Breton Hills drop steeply to the lake. Red spruce and hemlock occur on the steep slopes along streams and rivers, in dissected valleys, and on the valley floors but is rare elsewhere in the forests along the Bras d'Or Lakes. Prior to the extensive clearing and farming of the interval lands Stanley (1968) suggests in his study that these lands supported forests of American elm, sugar maple and white ash with scattered white spruce and balsam poplar.

Ecodistricts of the Northumberland Bras d'Or Lowlands Ecoregion

510 - Bras d'Or Lowlands	*2135 km²*	*540 - Cumberland Hills*	*932 km²*
520 - St.Georges Bay	*935 km²*	*550 - Tantramar Marshlands*	*185 km²*
530 - Northumberland Lowlands	*2783 km²*	*560 - Chignecto Ridges*	*784 km²*

510 - Bras d'Or Lowlands Ecodistrict

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMKK	39309	18.4	18.4
IMHO	38427	18.0	36.4
IFHO*	24842	11.6	48.0
WMHO	18177	8.5	56.5
WMDM	13488	6.3	62.8
IFKK	12789	6.0	68.8
WMRD	9358	4.4	73.2
WCHO	8104	3.8	77.0
WFKK	7692	3.6	80.6
WFHO*	6706	3.1	83.7
IMRD	5175	2.4	86.1
IMSM	3566	1.7	87.8

*These ecosections have karst topography with sinkholes, 7,179 hectares have been identified on these and other ecosections within the ecodistrict.

This ecodistrict encompasses the lowland areas around the Bras d'Or Lakes and the Sydney coalfield, Boularderie Island and the Salmon River Valley on the east side of the East Bay Hills. When compared to the climate of the surrounding uplands, this ecodistrict receives the benefit of a moderated climate due to its proximity to the large body of inland salt water and by the shelter afforded by the surrounding uplands of the Cape Breton Hills Ecodistrict (310). The Bras d'Or Lake occupies nearly 260 km^2 in the centre of Cape Breton Island, with West Bay being a wide extension on the southwest side and the long tapering East Bay extending 40 km in a northeasterly direction. These bays and channels have been carved mainly from the easily erodible Windsor sediments. Locally, thick deposits of gypsum, anhydrite, and salt occur. The bays and channels are elongate, parallel to ridges of gypsum dominated bedrock, with good examples of this feature near the community of Iona. Throughout the ecodistrict, white gypsum cliffs and red sandstone can be observed, especially along the shoreline of the lakes. The eastern half is covered predominately with shallow, stony, moderately coarse-textured glacial till derived from the underlying sandstones. The western half of the ecodistrict is dominated by imperfectly drained, loam to clay loam soils, whereas the soils on the eastern side have developed on shallow, stony, gravelly, sandy loam glacial till derived predominately from sandstone. Freshwater, excluding the Bras d'Or Lakes, makes up 2.6% of the ecodistrict or 5500 hectares. The total area of this ecodistrict is 2,135 km^2 or 28% of the ecoregion.

Balsam fir has re-established on most forested lands that have been disturbed by harvesting or by natural causes such as fire, blowdown or insect defoliation. However, the predominant species on the lowlands include black and white spruce. On steeper slopes, white pine can be found, while red spruce and hemlock will be found in the valley canyons, steep ravines and along some watercourses coming off the uplands. The better drained hills support stands of lower quality tolerant hardwoods such as sugar maple, yellow birch and beech. The clearing of land by early settlers and then subsequent abandonment of the fields and pastures has given rise to large areas of old field white spruce. Natural disturbances include losses to blowdown in exposed areas along the lakes and coast.

520 - St. Georges Bay Ecodistrict

The lowlands wrapping around St. Georges Bay extend inland to the Mulgrave Plateau (360) on the mainland and the Cape Breton Hills (310) on the island. Including most of Antigonish County and incorporating the Judique lowlands, this area has been used extensively for farming. It occupies roughly an area of 935 km^2 or 12% of the ecoregion. Overall the climate is characterized by a late cold spring and moist summer, resulting in adequate moisture throughout the growing season. In eastern Nova Scotia this ecodistrict is one of the warmest during the summer with an average temperature of 16.7 C^{o}. For the most part elevations are between 30-60 m above sea level although there is a consistent rise in elevation from the coast to about 150 m. Much of this elevation is on gently rolling hills that have been cleared and used for agriculture.

Underlying the ecodistrict are Lower carboniferous sedimentary rocks. In some areas, gypsum outcrops and associated karst topography can be seen, for example the cliffs along St.Georges Bay north of Antigonish. Adjacent to the major rivers of the ecodistrict deposits of alluvium and ice-contact stratified sand and gravel can be found. The soils of the ecodistrict are dominated by moderately well and imperfectly drained gravelly loams and gravelly clay loams. Well drained sandy loams are predominant along the coast, with rapidly drained, gravelly sandy loams located on the glacially derived soils on the outwash plains of the major rivers. The alluvial soils are usually moderately well drained silty, clay loams.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WFKK	39090	41.8	41.8
WFHO	10568	11.3	53.1
IFHO	9611	10.3	63.4
IFKK	7111	7.6	71.0
IFSM	4941	5.3	76.3
WMHO	4761	5.1	81.4
WMKK	4477	4.8	86.2
WCHO	3689	4.0	90.2
WATER	810	0.9	91.1

The extensive agricultural history has removed most of the natural forest associations. Abandoned agricultural lands revert to stands of white spruce. In Antigonish County there are more than 10,000 hectares of forest stands where white spruce comprises at least 30% of the cover. However, pre-settlement forests most likely included tolerant hardwood stands of sugar maple, yellow birch and beech on the upper slopes, with tolerant softwood stands of red spruce, white pine and hemlock on the lower slopes. Imperfectly drained flats are dominated by black spruce as can be observed along the Judique shore. Recently disturbed forested sites will regenerate with balsam fir, red maple, white birch and, on the wetter sites, aspen and tamarack.

530 - Northumberland Lowlands Ecodistrict

This lowland area in northern Nova Scotia borders on the Northumberland Strait and extends into New Brunswick where the ecodistrict is called the *Northumberland Coastal,* which is within the *Eastern Lowlands* (NBDNRE 1997). On this low plain, elevations seldom exceed 50m. It is bounded on its southern border by the uplands of the Cobequid Mountains and the Pictou Antigonish Highlands and to the west by the Cumberland Hills. The only significant elevation included in the ecodistrict is the area near Streets Ridge, which rises only 100 m above sea level. The growing climate of this ecodistrict is one of the best in Nova Scotia. Because the ecodistrict is sheltered from storms from the south and

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
IMHO*	101848	36.6	36.6
WMHO*	46351	16.7	53.3
IFHO*	37310	13.4	66.7
WFKK*	17124	6.2	72.9
WMKK	12736	4.6	77.5
IFRD	11211	4.0	81.5
IMRD	10932	3.9	85.4
ICHO	5830	2.1	87.5
WCKK	3850	1.4	88.9
WCHO	3594	1.3	90.2

* Stands of jack pine, red pine and black spruce are common in areas of these ecosections that have a history of frequent wildfires.

the east, it has a significant moisture deficit second only to the Annapolis Valley. It also receives the lowest annual mean precipitation in the province at 1128 mm. The total area of the ecodistrict is 2783 km^2 or 36% of the ecoregion.

The surficial till of the ecodistrict is derived from the underlying Carboniferous sediments, the most prominent being the fine red sandstones which are conspicuous on the cliffs along the Northumberland shore. Scattered along the ecodistrict are occurrences of gypsum and salt. The most notable karst topography is near Oxford where many of the smaller sinkholes are filled with water. Of all the watersheds in the ecodistrict, only the Nappan drains westward to the Cumberland Basin while the remainder drain north to the Northumberland Strait. In total only 4500 ha (1.6%) of freshwater occurs in lakes and rivers. The ecodistrict is characterized by imperfectly drained soils found on compact, slowly permeable, basal tills derived mainly from red sandstones and shales. Due to the compacted nature of the subsoil most water must be removed laterally or through evapotranspiration. Imperfectly drained, reddish brown sandy loams, loams, and clay loams occupy extensive areas of the undulating to rolling plain. Better drained soils are found on the upper slopes on permeable sandy loam tills. Ridged topography, usually with a thick veneer of till, is prominent throughout the ecodistrict, especially in north Colchester county with a good example along the highway between Denmark and Brule.

The ecodistrict is dominated by coniferous forest, with black and red spruce the dominant species. Following disturbance, either by natural causes or forest harvesting, sites are usually invaded by early successional species such as balsam fir, red maple, white birch and both trembling and largetooth aspen. A history of fire has produced several areas, most notable along both the Cobequid Pass and the Trans Canada Highway near Oxford and Springhill, where jack pine and black spruce produce an edaphic climax association. The better drained, upper slopes and hilltops will support a forest of tolerant hardwoods but these are rare throughout the ecodistrict. As mentioned earlier, fire is a significant natural disturbance in this ecodistrict due to the warm summers and significant moisture deficit that occurs in many of the ecosections. As well, wind throw is significant as many forests are shallow rooted trees on imperfectly or poorly drained soils. Another somewhat unique feature of this ecodistrict is the occurrence of tamarack on abandoned farmland where the soils were imperfectly drained. On other abandoned fields in the ecodistrict white spruce will follow alders. Eastern white cedar is found scattered throughout the ecodistrict, most notably near Oxford on imperfectly drained soils and where seepage on slopes provides the moisture and nutrients required for it to establish and compete with other softwoods.

540 - Cumberland Hills Ecodistrict

Rising above the lowlands of the Northumberland Lowlands Ecodistrict (530), but still in the shadow of the Cobequid Mountains (340), lies the Cumberland Hills. These rounded hills seldom exceed 150 m above sea level, with exceptions near Springhill and Leicester where elevations are just over 180 m above sea level. The climate of the ecodistrict is slightly cooler than the adjacent lowlands and receives slightly more moisture. The total area of the ecodistrict is 932 km^2 or 12% of the ecoregion.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WCKK	36453	39.1	39.1
WCHO	18242	19.6	58.7
WMKK*	11643	12.5	71.2
ICHO*	9888	10.6	81.8
WMHO*	4612	5.0	86.8
IMHO	3474	3.7	90.5

* Stands of jack pine, red pine and black spruce are common in areas of these ecosections that have a history of frequent wildfires.

The bedrock geology is generally Carboniferous era sedimentary rocks. Leicester Ridge divides two watersheds, with the Little River draining east to the River Philip and the Little Forks River flowing west to the Maccan River. Near Springhill, the Black River flows to the Maccan River. The majority of soils in this ecodistrict are derived from sandstones and conglomerates creating well drained, coarse textured, sandy loams. Finer textured soils such as clay loams have developed from shales and mudstone, and are imperfectly drained.

The upland sites are a mixture of tolerant softwood and hardwood stands, including red spruce, sugar maple, beech and yellow birch. Imperfectly drained sites are occupied by black spruce. Areas with coarse textured soils are prone to moisture deficits in the summer and are susceptible to fire. Examples of jack pine, white pine and black spruce on fire disturbed sites are scattered near Springhill and along the Little Forks River. Along with fire, natural disturbances on the better drained sites with tolerant species include blowdown and insect mortality.

550 - Tantramar Marshes Ecodistrict

The smallest and one of the most distinctive ecodistricts in the province, the Tantramar Marshes provide a natural boundary between Nova Scotia and New Brunswick at the Isthmus of Chignecto. The flat terrain on tidal sediments is occupied by extensive grasslands which have replaced the salt water marshes that were dyked long ago by early Acadian settlers from the tidal waters of the Bay of Fundy. The Tantramar Ecodistrict occupies 185 km^2 or 2% of the ecoregion. The ecodistrict

receives strong winds and experiences cooler than normal temperatures than elsewhere in the ecoregion due to its proximity to the bay.

The ecodistrict is predominantly comprised of imperfectly drained to poorly drained soils. Approximately 52% of the ecodistrict occurs as peat lands and bogs. The peat lands are about one metre thick and have formed in the low lying depressions of the ecodistrict. The mineral soils reclaimed from the salt marshes are mainly silty clay loams showing minimal horizon development because of the continuous deposition of marine sediments prior to dyke construction.. The mineral soils adjacent to the peat lands are usually poorly drained sandy loams.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
PFSM	9448	51.2	51.2
IMHO	4931	26.7	77.9
IMSM	859	4.7	82.6
IMRD	544	3.0	85.6
WMHO	518	2.8	88.4
IFSM	271	1.5	89.9

The Fort Lawrence ridge is the only portion of the ecodistrict where a tolerant mixedwood occurs. Ecsections which occur inland from the dykelands and marshes are occupied with black, red or hybrid spruce, red maple and tamarack.

560 - Chignecto Ridges Ecodistrict

The ridging in this ecodistrict is easily observed on aerial photographs. This folding of the underlying strata, made up of grey sandstones, siltstones and shales, can be found throughout the Chignecto Game Sanctuary. Another interesting glacial landform in this ecodistrict is the esker (a linear to meandering ridge consisting of sorted sand and gravel deposits created by water flowing beneath a glacier (Cauboue et al 1996)). The Boar's Back Road through the sanctuary has been constructed on top of an esker. Occupying most of northern Cumberland County, this ecodistrict is a plain tilting towards Chignecto Bay. Elevation seldom exceeds 120 m above sea level. The total area of the ecodistrict is 784 km^2 or 10% of the ecoregion. The western boundary is the Bay of Fundy and although there is a moderate influence on forest growth close to the water, this effect is not reflected very far inland. Therefore it did not seem to warrant further delineation of another ecodistrict. Overall the climate is similar to the Cumberland Hills Ecodistrict.

Underlying this ecodistrict are the coal bearing Carboniferous strata, with coal seams at Joggins, Springhill, River Hebert and Maccan. The strata include coarse and fine grained sandstones,

Ecosection	Rockland (%)	Area (ha)	% Ecodistrict	Cumulative %
ICHO	0	33777	43.1	43.1
WCHO	0.2	16807	21.4	64.5
ICRD	15.9	9419	12.0	76.5
WCRD	16.9	7513	9.6	86.1
IFHO	0	2486	3.2	89.3
IMHO	0	1620	2.1	91.4

* Stands of jack pine, red pine and black spruce are common in areas of these ecosections that have a history of frequent wildfires.

which are exposed in some locations (Chignecto Game Sanctuary) and overlain by sandy tills to the east of the River Hebert. For the most part this ecodistrict is characterized by shallow, imperfectly drained soils derived from sandstones. In many of the soil landscapes, drainage is influenced by the haphazard arrangement of the bedrock which creates a pattern of imperfectly and poorly drained soils.

On the ridged ecosections, repeated wildfires have resulted in stands of jack pine, black spruce, red maple and white birch. Many of these stands over time would progress to include red spruce, white pine and hemlock. Fire and glacial activity have resulted in large area of thin soils and exposed bedrock in this ecodistrict. The steep slopes along the Bay of Fundy and the better drained, deeper soils inland support stands of red spruce. On upper slopes and crests of well-drained ecosections, stands of tolerant hardwoods include sugar maple and yellow birch.

600 - Valley & Central Lowlands Ecoregion

Easily defined, the Valley & Central Lowlands Ecoregion includes the Annapolis Valley, the watersheds of the Minas Basin and the Musquodoboit Valley. The elevation of this lowland seldom exceeds 50 m above sea level, with only a few points reaching 100 m above sea level. Triassic sandstones underlie the Annapolis Valley and Minas shore portions of the ecoregion, while Carboniferous shale, sandstone, gypsum and limestone underlie the lowlands within Hants, Halifax and Colchester Counties. Locally, in the areas underlain by gypsum, karst topography with sinkholes and caves can be expected. Hayes Cave near South Maitland is the best example of a well developed cave. Very coarse to moderately coarse sandy soils occupy much of the Annapolis Valley and along the Minas shore. Otherwise, imperfectly drained, fine textured soils predominate on the gently undulating to moderately rolling plains of the central river watersheds of Shubenacadie, Stewiacke, Kennetcook, Avon, St.Croix and Musquodoboit. Excluding the latter, all these rivers are influenced by the tides of the Bay of Fundy and muddy tidal flats extend inland for considerable distance. Another significant landform feature of the ecoregion are the extensive bogs in central Hants County, which include much of the area near Stanley. Notable bogs include the Collins and McDonald bogs

both of which exceed 400 ha. Poorly drained clay loams underlay most of this area. The total area of the Valley & Central Lowlands Ecoregion is 4129 km^2 or 7.5 % of the province.

Distinguishing Ecoregion Feature: *Lowlands sheltered from coastal climatic influences with warmer summer temperatures and milder winters than elsewhere in the province.*

Some of the ecoregion is protected from direct coastal influences by the North Mountain and its promontory, Cape Split. Two notable uplands bordering the ecoregion, the Rawdon Hills and Wittenburg Ridge, also shelter the adjacent lowlands. Other parts of the ecoregion are sheltered within the river valleys by the gently rolling topography. As a result, the ecoregion records some of the hotter summer temperatures within the province, particularly in the eastern portion of the Annapolis Valley. Winter temperatures tend to average - 4.5^{o}C. The mean annual precipitation ranges from 1100 - 1300 mm.

A wide range of forest species associations occur throughout the ecoregion. On the imperfectly drained, finer textured soils, red spruce and balsam fir are predominant. On sites where drainage is better, hemlock and white pine combine with red spruce to form stands more representative of the zonal sites. Since much of the area features heavy textured soils and poor drainage, black spruce and red maple occupy the sites capable of forest growth. On the better drained sites located on ridges and upper slopes, tolerant hardwood such as sugar maple, yellow birch and beech occur. These stands also include trees typical of wetter sites creating mixedwood opportunities. On the fire sites, red maple, red oak, red pine, jack pine, grey birch and black spruce occupy much of the lowland sites. Red pine can be found in pure stands on a range of sites, including the well drained, coarse textured soils of the Valley to the imperfectly drained, fine textured sites in Hants County. Wildfires have been the dominant natural disturbance throughout the ecoregion, but fire suppression and European settlement have reduced the impact of this disturbance on the forested ecosystems. Much of the ecoregion is or has been farmed, and extensive land reclamation has occurred along the tidal shores through the use of dykes dating back to the time of the Acadians.

Ecodistricts of the Valley & Central Lowlands Ecoregion

610 - Annapolis Valley	*928 km^2*
620 - Minas Lowlands	*462 km^2*
630 - Central Lowlands	*2739 km^2*

610 - Annapolis Valley Ecodistrict

The Annapolis Valley is bounded on the north by the North Mountain (920) and on the south by the Valley Slope (710). It is about 130 km long and varies in width from 3 to 11 km. The small nearby Gaspereau Valley has been included in this ecodistrict. The shelter provided by the North and South Mountains allows the Annapolis Valley to have early springs and hot summers, making it one of Nova Scotia's most prominent agricultural areas. The total area of the ecodistrict is 928 km^2 or 22% of the ecoregion.

The valley is underlain by Triassic sedimentary deposits which have provided the parent material for the sandy soils found in the ecodistrict. The valley is drained by two rivers: the Annapolis River flows southwest to the Annapolis Basin and the Cornwallis River flows northeast to the Minas Basin. The headwaters of both rivers is the large peat land, Caribou Bog, near Berwick. The high tides of the Bay of Fundy affect both basins and have formed extensive areas of tidal salt marsh. Most of this marshland, which is now protected from the saltwater by a system of dykes, is used for agriculture. The dykes were originally built by the early French settlers in the 1600's. These dykelands have fine-textured soils derived from marine silt. Aside from a few small ponds, freshwater on the valley floor is limited to streams and rivers and occupies only 1.8% of the ecodistrict.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMHO	16585	17.9	17.9
WCHO	11086	11.9	29.8
WCSM	9531	10.3	40.1
ICSM	9206	9.9	50.0
IMHO	6535	7.0	57.0
WMSM	6259	6.7	63.8
WFHO	5493	5.9	69.7
IFHO	5346	5.8	75.5
IFSM	3868	4.2	79.6
PCSM PMSM PFSM	11005	11.9	91.5

Since the climate and soil are so favorable for agriculture, there is little left of the original forest. The well-drained sandy soil supports pure stands of white pine, red pine and red oak or mixtures of all three of these fire species. Some of the sandy sites are somewhat barren, probably as a result of repeated fires. A few jack pine are found here with the other pines. Areas near the rivers, where there is more silt in the soil, once supported a riparian hardwood forest with elm, black cherry, and black ash. There are still a few locations where cedar is found and it was probably more common at one time. Red spruce and hemlock grow on the north facing valley slope, and extend into the valley on the moist sites. In many

locales the valley floor is not flat but comprised of small hills and hummocks where the soil is not excessively sandy. These sites would have supported tolerant hardwoods on the upper slopes and red spruce, hemlock and pine on the lower or shaded slopes. Black spruce and larch grow on the wetter sites. Scattered red pine will also be found on these imperfectly to poorly drained soils which is contrary to the silvics of the species but not unusual in this ecodistrict. Throughout the valley and on the better drained soils sugar maple, yellow birch, beech and ironwood will be found but they rarely ever form pure hardwood associations occurring instead with white pine, hemlock and red spruce.

620 - Minas Lowlands Ecodistrict

Surrounding the Cobequid Bay and encompassing the adjacent lowlands this ecodistrict covers an area of 462 km^2 or 11% of the ecoregion. Along the southern shore of the bay the ecodistrict is fairly narrow until it approaches Truro, where it widens and extends inland to the Cobequid Slopes Ecodistrict (350). Several major rivers pass through the ecodistrict including the Shubenacadie, Salmon, Chiganois, Folly, Debert and Bass. Much of the area is close to or below sea level, with the highest elevation seldom exceeding 40 m above sea level. The climate is such that on the better soils, conditions permit the growing of many of the crops associated with the Annapolis Valley, such as corn and strawberries.

The entire ecodistrict is underlain by the Triassic era red siltstones and sandstones. On the north shore of the Cobequid Bay most of the ecodistrict has been covered by glacial deposits of sand and gravel which have formed deep beds. Evidence of this can be seen in the extensive aggregate quarries outside of Truro. The soft sandstones along the bay have been gradually eroding and extensive tidal flats on both sides of the bay are evidence of a once larger land mass.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMHO	17206	37.3	37.3
IMHO	10722	23.2	60.5
WCHO	4227	9.2	69.7
IMSM	3255	7.1	76.7
IFHO	1772	3.8	80.5
WMKK	1071	2.3	82.9

The forests of this ecodistrict are predominantly comprised of softwood species, with very few stands of tolerant hardwood. Only on the few well-drained hills will the presence of sugar maple and beech be noted. Elsewhere, the tolerant hardwoods will be found growing in mixedwood associations with red spruce, hemlock and white pine, particularly on the steep-sided slopes of the streams and rivers flowing to the bay. Where the soils are imperfectly to poorly drained, the forests

are dominated by black spruce and scattered with white pine on the better drained microsites. These forests are replaced with stands of red spruce and a lesser component of hemlock on better drained soils. A few areas of the ecodistrict have deep, dry, coarse sandy soils where red pine and white pine occur which could have originated after fire. Similar to the Annapolis Valley Ecodistrict, the Minas Lowlands have very little in the way of lakes, with most of the freshwater resource (1.9% of the ecodistrict) occurring in streams and rivers and a few small ponds. Scattered along the shoreline of the basin is a substantial area of salt marshes (1,042 hectares or 2.3% of the ecodistrict). Since European settlement the construction of dykes has been used to claim farmland from the tidal waters of the bay.

630 - Central Lowlands Ecodistrict

In central Nova Scotia lies a significant lowland encompassing much of Hants and Colchester counties. A significant feature of this central basin is the extent to which it is drained by several large rivers, all of which are affected by the tidal movements of the Bay of Fundy. The only exception is the Musquodoboit River, which drains to the Atlantic Ocean. Most of the ecodistrict is fairly level with hummocky to undulating topography, with elevations seldom exceeding 90 m above sea level. The climate is conducive to farming and the area has been extensively used for dairy and beef production and the growing of forage and cereal crops, including corn. The total area of the ecodistrict is 2,739 km^2 or 66% of the ecoregion.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
IFHO*	56278	20.6	20.6
IFKK	44132	16.1	36.7
WFHO*	27168	9.9	46.6
IFRD	24779	9.1	55.6
WFKK	17834	6.5	62.1
IMHO	17570	6.4	68.6
IFSM	13324	4.9	73.4
IMSM	10503	3.8	77.3
WMKK	9904	3.6	80.9
IMRD	8361	3.1	83.9
WMHO	8134	3.0	86.9
PFSM, PCSM PMSM	12546	4.6	91.5

*These ecosections have karst topography with sinkholes; 11,715 hectares has been identified on these and other ecosections within the ecodistrict.

This ecodistrict is underlain by Carboniferous shale, limestone, sandstone and gypsum. Karst topography (sink holes) is common on areas underlain by gypsum in the southwest of the ecodistrict. Glacial outwash deposits, some of which have been quarried for aggregate, are abundant, especially alongside the rivers. However, most of the ecodistrict has fine textured soils comprised of loams, silts and clays. These deep, reddish-brown soils are characteristic of the ecodistrict and have been derived from the underlying Carboniferous rock. The drainage has been restricted on most of the soils due to glacial compaction of these finer textured soils. An area of sandier soils is found south of the river near Upper Kennetcook. A conspicuous feature of the ecodistrict is the abundance of large peat lands and adjacent areas of imperfect to poorly drained forests over impermeable clay loam till on level terrain near the Cogmagun and Tom Cod rivers. A few freshwater lakes dot the ecodistrict but when added to the streams and rivers the total area is only 4,029 hectares or 1.5% of the ecodistrict.

As is characterized by the ecoregion, the forests of the Central Lowlands Ecodistrict are predominantly softwood. Only on a few well-drained hills will pure stands of tolerant upland hardwood be found. Usually yellow birch will grow in association with red spruce on the well-drained hummocks mixed with an occasional occurrence of beech, sugar maple and hemlock.. Red spruce with scattered white pine and hemlock may occur on the better drained sites, with the latter species being found predominantly on steeper slopes near streams and rivers. On sites where soils are derived from the glacial outwash till, white pine will occupy the coarser soils. Forests of black spruce and scattered white pine will be found on the imperfectly drained soils. An unusual association is the occurrence of red pine with black spruce on the imperfectly and poorly drained clay soil that is prominent on the smooth topography of the watersheds of the Tom Cod and Cogmagun rivers. Many of these spruce/pine sites have originated from fire. The suppression of fire in this ecosystem may lead to the absence of red pine in the future.

700 - Western Ecoregion

The Western Ecoregion extends from Yarmouth to Windsor and includes the Halifax peninsula. The ecoregion excludes the Annapolis Valley and the coastal ecoregions along the Bay of Fundy and the Atlantic Ocean. The surface of this region is part of the Appalachian peneplain which tilts towards the southeast, creating some of the longest rivers in Nova Scotia. Elevations of 200 m or more are common on the South Mountain while still in view of the Valley floor (maximum of 289 m near Salmontail Lake, Kings County) and gently tapers to the Atlantic coast with elevations of 25-50 m above sea level. The ecoregion is underlain by Meguma slate and quartzite, as well as the extensive granitic South Mountain batholith (a massive intrusion of igneous rock caused by upwelling magma

and forced into the surrounding rocks). Significant portions of the ecoregion in the southwest are covered by wetlands. The center of the ecoregion is occupied by an extensive drumlin field that is dissected by the LaHave River. The total area of the Western Ecoregion is 16 904 km^2 or 30.6 % of the province.

Distinguishing Ecoregion Feature: A*n upland tilting towards the Atlantic Ocean comprising the southwestern half of the peninsula of Nova Scotia and with milder weather conditions than the eastern portion of the mainland.*

The climate of the Western Ecoregion is mild winters (average -3.5^{o}C) and warm summers, with total precipitation between 1300-1500 mm per year. Since no part of the ecoregion is more than 60 km from the Atlantic Ocean or Bay of Fundy, significant temperature and precipitation variation can occur.

Forest stands of red spruce, hemlock and white pine are most prominent in the Western Ecoregion and perhaps more so than anywhere else in the province. Stands of this distinctive Maritime forest occur on the sandy and generally shallow soils of the ecoregion. Other dominant trees include the fire species red oak and red pine. Pure stands of white pine can be found on the drumlins, eskers and flutes of the barren lands and occupying abandoned fields on the drumlins along the LaHave River and elsewhere. Although balsam fir occurs in most of the forest types, its dominance within stands has been reduced by the damaging effects of the balsam woolly adelgid (*Adelges piceae*) a gout-causing forest pest introduced from Europe circa 1910. Significant portions of the ecoregion are occupied by stunted forests of black spruce on the bogs. Large tracts of red maple occur on other wetlands associated with the western rivers.

A conspicuous feature of this ecoregion are the extensive barrens occupied by sparse forests of black spruce and white pine with a shrub and herb layer dominated by a variety of ericaceous (heath) plants such as lambkill, huckleberry, rhodora, leather leaf, bearberry and black crowberry. Gorman (1955) reported a theory by Titus Smith on the anthropogenic origin of the heathland - repeated fires for domestic forage production (circa 1780) produced a complete change in the forest. Smith stated that "the ground becomes so much exhausted that it produces only a growth of heathy shrubs" and that "it is probable that at no very distant period, many large tracts will present nearly the same appearance as the naked heaths and downs of the old world". Strang (1972) concluded in his study on these barrens that "although fire is undoubtedly a potent factor in maintaining the shrub cover, pollen analyses indicate that an open woodland developed many centuries ago in response to the soil conditions and prevailing climate. The present shrubby vegetation is thus an expression of inherent site factors as well as of the effects of burning." Most likely the early fires of the European settlers aggravated an already fragile environment, but as Smith also reported after his 1801-02 travels,

as long as fire is not so frequent that turf cannot be re-established then trees may be re-established. Fire suppression has significantly reduced the amount of area burnt by wildfire over the past century in the Western Ecoregion. The result of this can be seen in the increased acreage of young forest now occupying the barren lands.

Natural disturbances such as fire and blowdown have been an important component in forest succession of the ecoregion. During his western tour of the province in 1802, Titus Smith described large areas destroyed by fire and blowdown. Between St. Margaret's Bay and Chester, Smith wrote that he had been "remarkably delayed by windfalls being sometimes obliged to spend ½ hour in going 100 yards...." The high hazard of fires and the frequent wind damage from hurricanes have the potential to create large openings in the forest cover. However, old growth forests of pine, hemlock and spruce can be found in the ecoregion, indicating the infrequency of catastrophic stand disturbances. A more recent impact on the ecosystems (terrestrial and water) of this region are the acidic inputs from precipitation that originates from industrial regions of the continent. Large areas of the ecoregion do not have the buffering capacity within the soils to neutralize these acidic depositions, therefore increasing the acidity of many fresh water rivers and lakes. Since early settlement by Europeans, most of this ecoregion has been extensively logged several times to provide timbers and pulpwood.

Ecodistricts of the Western Ecoregion

710 - Valley Slope	*885 km²*	*750 - Rossignol*	*1179 km²*
720 - South Mountain	*6480 km²*	*760 - Sable*	*2861 km²*
730 - Clare	*1964 km²*	*770 - Flint*	*790 km²*
740 - LaHave Drumlins	*2745 km²*		

710 - Valley Slope Ecodistrict

The Valley Slope Ecodistrict includes a series of hills and slopes with a northwesterly aspect. The ecodistrict is bounded by the Annapolis Valley (610) and the South Mountain (720) Ecodistricts and extends from the Bear River and Acacia Valleys in the west to Mount Denson in the east. With a climate warmed by the westerly exposure and far enough inland that the cold waters of the Bay of Fundy do not impact local climate, these slopes have been used extensively for apple orchards and mixed farming. The total area of the Valley Slope Ecodistrict is 885 km² or 5% of the ecoregion.

Between Annapolis Royal and Middleton, Devonian granites constitute the bedrock. Soils on this parent material tend to be coarse to moderately coarse, well drained and commonly gravelly with surface stones limiting both machine operability and tree stocking levels. However, slates,

schists and quartzites of the Meguma Group underlie the slopes in Kings County , providing well drained, moderately coarse to medium textured soils. There are only two areas of the ecodistrict where finer textured soils occur and these are underlain by Horton Group sandstones near Middleton and Hantsport.

On the upper slopes of the well-drained ecosections, tolerant hardwoods are the climax forests. Sugar maple, beech and yellow birch with scattered white pine dominate these sites. Further down the slope and in the shaded dissections (ravines), hemlock and red spruce are found with a good example at Kentville Ravine. On moist soils, the climax forest is comprised of tolerant softwoods, including red spruce, hemlock , white pine and balsam fir.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WFKK	27849	31.5	31.5
WFHO	13190	14.9	46.4
WMHO	11844	13.4	59.8
WCKK	9949	11.2	71.0
WMKK	6749	7.6	77.6
WCHO	4704	5.3	82.9
IFHO	4544	5.1	88.0
WMDS	2712	3.1	91.1

720 - South Mountain Ecodistrict

The South Mountain Ecodistrict, the largest in the classification, is a fairly homogenous land mass underlain by Devonian granite (the South Mountain Batholith). It extends from the headwaters of the Tusket River to the Halifax peninsula wrapping around the LaHave Drumlin Ecodistrict (740). In western Nova Scotia, the highest elevations of 200-250 m above sea level are found within this ecodistrict in an area stretching roughly from Paradise Lake to Gaspereau Lake. The headwaters for some of the province's longest rivers, including the Tusket, Medway, Mersey, LaHave, Jordan, and Roseway are located in this ecodistrict. The climate consists of warm, early springs and warm, dry summers which, when combined with the coarse, shallow soils, creates periods in the growing season where moisture deficits can be significant. Winters are moderately mild, although if snow is going to accumulate in western Nova Scotia, it is most apt to do so in this ecodistrict due to the higher elevation. The total area of the South Mountain Ecodistrict, is 6,480 km^2 or 38% of the ecoregion.

The predominant soils are well-drained, coarse sandy loams that have developed on granite till. For the most part the soils are shallow, stony and dry. Furthermore, the landscape is dotted with large granite boulders which restrict operability and, in some cases, limit stocking levels within forest stands. Approximately 5.5 % of the ecodistrict has exposed bedrock due, in part, to the

absence or shallowness of the glacial till and repeated wildfires, which have prevented the accumulation of organic matter. Even in areas where the soil drainage is imperfect to poor, the soils are usually coarse textured, sandy loams. Approximately 7.5 % or 486 km^2 of the ecodistrict is comprised of lakes and rivers.

Fire has played a dominant role in shaping the forests of this ecodistrict and fire species such as white pine, red pine and red oak occur on sites where the soils are well drained, as would be found on upper slopes and ridges. Many fire sites will reforest with black spruce and white pine and develop a significant understory layer of ericaceous (heath) vegetation. Those areas where the soils are moist, for example on middle to lower slopes, will be occupied by red spruce and hemlock. The tolerant hardwoods will also occupy the unburned sites on upper slopes and will include sugar maple, beech, yellow birch and red oak.

Significant areas of barren land occur in the vicinity of the Shelburne River. Here, dense vegetation of huckleberry, rhodora and lambkill restrict softwood regeneration creating sparse stands of white pine and black spruce. However, on sites that have been spared the effects of repeated fire, old growth red spruce, hemlock and white pine are found, with one of the province's best examples of old growth on Sporting Lake Island. This association of red spruce, white pine and hemlock is consistent and repeats throughout the ecodistrict and is associated with the WCKK and WCHO ecosections, coarse textured, well-drained soils on hills and large hummocks of the uplands. Smith (1857) reported extensive areas of the Acadian softwood climax forest of red spruce, hemlock and white pine during his western tour of the province in 1802. Where these ecosections have been repeatedly burned, especially in the western portion of the ecodistrict, forests of white and red pine and red oak are common. Repeated wildfires (both natural and anthropogenic) and a history of intensive harvesting since European settlement in the 1600's has influenced the composition of the forest. Large areas of red maple and white birch can be found in the ecodistrict, with the expectations that if fire can be eliminated from the site they will eventually revert to the tolerant hardwood and softwood associations as characterized by the few remaining old growth examples in the ecodistrict.

An area of drumlins near Fisher Lake (Annapolis County) has been included as part of the ecodistrict. There are many drumlins scattered throughout the ecodistrict, but they do not dominate the landscape to the extent that they require a separate ecodistrict designation (less than 3% of the total area of the ecodistrict). Usually the tops and upper slopes of drumlins are occupied by forests of tolerant hardwoods such as sugar maple, yellow birch and beech, with occasional red oak on fire sites. Middle and lower slopes are occupied with tolerant softwood such as red spruce, white pine and hemlock. These same species will also occupy the well-drained matrix between drumlins or, where soils are imperfectly drained, will be replaced by black spruce and scattered white pine and red maple. The Panuke Lake old growth hemlock stand is on a well-drained, coarse textured drumlin ecosection (WCDM). Abandoned farmland on drumlins tends to reforest with white pine.

Ecosection	Rockland %	Area (ha)	% Ecodistrict	Cumulative %
ICHO	4.3	217978	33.6	33.6
WCKK	10.1	142896	22.1	55.7
WCHO	6.5	138695	21.4	77.1
ICSM	2	26408	4.1	81.2
PCSM	1.4	18277	2.7	83.9
WCDM	1.3	11197	1.7	85.6
WMHO	0	9239	1.4	87.0
WMDM	0	7188	1.1	88.1

730 - Clare Ecodistrict

This ecodistrict is easily separated from its two neighboring ecodisricts, the South Mountain ecodistrict (720) by soil texture and from the Sable ecodistrict (760) by soil drainage. It extends from Digby to Yarmouth. The ecodistrict is heavily covered with lakes and rivers (9.4%). Early, mild springs followed by cool summers and mild winters describes the climate of the ecodistrict. Approximately 1300-1400 mm of precipitation is received annually. The Clare Ecodistrict also has the longest growing season in the province, with 210 growing degree days (5^0C basis). The total area of the Clare Ecodistrict is 1,964 km^2 or 12% of the ecoregion.

The Clare Ecodistrict is located on an undulating to gently rolling, drumlinized till plain underlain by greywacke, slate, quartzite and schists. The soils that have developed on the slate and quartzite till plain are predominantly well-drained, stony, sandy loams on the gentle hummock topography and the drumlinized till plains. Imperfectly drained soils associated are found in the

depressions between drumlins and hummocks, as well as in those areas where internal drainage has been restricted due to glacial soil compaction.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
IMHO	69065	35.2	35.2
WMDM	49920	25.7	60.9
WMHO	29127	14.5	75.4
IMSM	13507	6.9	82.3
PMSM	7116	3.6	85.9
WMKK	2550	1.3	87.2

The forest associated with the various landforms has been changed by the long period of European settlement. However, it appears the upper slopes and tops of drumlins and hummocks supported stands of sugar maple, yellow birch and beech. On the moist lower slopes and on flatter areas between drumlins, red spruce, hemlock and white pine occurred. On the wetter, mineral soils, black spruce forests are common grading to red spruce, white pine and hemlock as drainage improves. It could be expected on the coastal areas where most of the natural forest has been cleared, that the well-drained sites supported tolerant hardwoods, red spruce and white pine. Wildfires caused by lightning are infrequent in this ecodistrict due to the amount of precipitation and the occurrence of fog in the summer. Other natural disturbances include losses to storm damage (most likely winter ice) and the occasional hurricane. Gap replacement events would include tree mortality due to insects and diseases. It is most likely that the forests of Clare are not subjected to massive natural stand initiating events unless it is the infrequent occurrence of fire.

740 - LaHave Drumlins Ecodistrict

Perhaps one of the better examples of a drumlinized till plain in eastern North America, this ecodistrict encompasses an area from New Ross in the east to Kejimukujik National Park in the west. This drumlin field exhibits the classic streamlined, tear-drop shaped deposits of glacial till, with the tapered or narrow end pointing in the direction of glacier movement. The ecodistrict slopes in a southeasterly direction toward the Atlantic Ocean with an average elevation of 107 m above sea level. The Ecodistrict is bounded on the south by the South Shore Ecodistrict (830) and by the granitic soils of the South Mountain (720) to the north and east. This area of Nova Scotia has perhaps the most pleasant climate of the province with early, warm springs and a long growing season, followed by a relatively mild winter. The area receives approximately 1400 to 1500 mm of precipitation annually. The total area of the LaHave Ecodistrict is 2,745 km^2 or 16% of the ecoregion.

Shallow, stony till derived from the underlying slates dominates the ecodistrict. Most of the soils can be characterized as well-drained, shallow, sandy loams except those developed on drumlins, which tend to be deeper and less stony. In the eastern portion of the ecodistrict the soils tend to be moderately well-drained, shallow, stony, gravelly sandy clay loams which are deeper and less stony on the drumlins. Variation does occur in the drumlin field near New Ross where a reddish, moderately fine-textured till overlies the granite bedrock and is stony and shallow. Much of the area between the drumlins tends to be shallow, imperfectly drained till where the slate bedrock is just below the surface on hummocky terrain with poorly drained soils in the depressions. Total freshwater area in the ecodistrict is 27,624 hectares or 10.1%.

Ecosection	Area (ha)	% District	Cumulative %
WMDM	70732	25.8	25.8
WFDM	33737	12.3	38.1
IMSM	31857	11.6	49.7
IMHO	23236	8.5	58.2
WMHO	23133	8.4	66.6
WFHO	18278	6.7	73.3
IMDM	15743	5.7	79.0
IMRD	5542	2.0	81.0
WMKK	5161	1.9	82.9
PMSM	5155	1.9	84.8

The ecodistrict is dominated by coniferous forests, but tolerant hardwoods will be found on the tops of drumlins and on the upper slopes of well-drained hills. Sugar maple, red oak and beech are also found on the valley floors of the major waterways. Smith (1857), on returning home after his western tour in 1802, reported elm in the LaHave River valley and that this was the first they had seen since leaving Halifax. Hemlock, red spruce and white pine will be found on the side slopes of the drumlins and on the moist soils of lower slopes. Large areas of imperfectly drained soils occupy the areas between drumlins and, in most cases, forests of black spruce with white pine are dominant. After disturbance, balsam fir is an early component of the coniferous forest in this ecodistrict and has been developed as a significant commercial resource as a preferred species for Christmas tree cultivation.

750 - Rossignol Ecodistrict

The Rossignol Ecodistrict is largely made up of low hills with elevations between 100-130 m above sea level. It includes Lake Rossignol, the largest lake on mainland Nova Scotia. The ecodistrict is bounded on the east by the LaHave Drumlins (740), on the west by the hills forming the valley of the Mersey River (Sable 760) and by the South Shore (830) Ecodistict. The Rossignol Ecodistrict has early springs, warm summers and mild winters. The total area of this ecodistrict is 1,179 km^2 or 7% of the ecoregion.

The bedrock is mostly Meguma quartzite and the soils are derived from glacial drift. The soils tend to be moderately coarse, stony and shallow making them unsuitable for agriculture. Forestry is the principal land use in the ecodistrict. Bogs are common in the depressions of the undulating topography. Freshwater lakes and rivers make up 18.3% of the ecodistrict, with another 5.6 % in wetland ecosections underlain with poorly drained, medium textured soils on smooth or level topography (PMSM). Smith (1857) described Lake Rossignol as " not a regular valley filled with water .... but a small concavity in a great plain of rocks...."

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMHO	50570	42.9	42.9
IMSM	14888	12.6	55.5
IMHO	12752	10.8	66.3
PMSM	6648	5.6	72.0
IMDM	6441	5.5	77.4
WMDM	2471	2.1	79.5
WMRD	1837	1.6	81.1

Forests in this ecodistrict are vulnerable to fire and wind damage. Hurricanes sometimes cause considerable blowdown. Fires are common, but the effects have not been so severe as to cause the extensive barrens more common further southwest.

On the upper slopes of the well-drained ecosections, the climax forest is hardwood. Yellow birch is the most abundant tolerant hardwood, with some sugar maple. Red oak is fairly common and beech was formerly abundant. White pine and red spruce are found mixed with the hardwood. On lower slopes and better drained sites between hills, the climax forest is hemlock, red spruce and white pine. Black spruce becomes dominant on imperfectly drained sites and treeless bogs are found on the wettest sites.

760 - Sable Ecodistrict

The Sable Ecodistrict is easily separated from the adjacent ecodistricts by the abundance of poorly drained soils and extensive areas of bogs and wetlands. The Sable Ecodistrict is bounded on the northeast by the hills bordering the valley of the Mersey River. Although the bedrock and soils are similar to the adjacent Rossignol Ecodistrict (750), the Sable Ecodistrict is somewhat less hilly with extensive areas of bogs - Dunraven Bog is one of the better known examples. Almost one-quarter of the ecodistrict is poorly drained. Only a few of the higher hills reach an elevation of 100m, and much of the ecodistrict is less than 60m above sea level. On the south it is bounded by the South Shore (830) Ecodistrict, which extends inland following inlets and harbors such as Port Joli, Port l'Hebert, Sable River, Jordan Bay and Shelburne Harbour. The Sable Ecodistrict extends west as far as Great Pubnico Lake, where it meets the coastal Southwest Shore Ecodistrict (840). On the northwest, the presence of drumlins and a higher percentage of well-drained ecosections serves to separate the Clare Ecodistrict (730). Coarse textured soils and granite bedrock delineate the boundaries of the Flint (770) and South Mountain (720) ecodistricts on the north. The Sable Ecodistrict is the most southerly part of Nova Scotia, excluding the adjacent coastal ecodistricts which are cooled in summer by the ocean, so the summers are hot. The total area of the ecodistrict is 2,861 km^2 or 17% of the ecoregion.

Ecosection	Rockland %	Area (ha)	% Ecodistrict	Cumulative %
IMHO	4.0	107981	37.7	37.7
PMSM	1.2	41570	14.5	52.2
WMHO	0.6	32044	11.2	63.4
IMSM	2.0	28354	9.9	73.3
PMHO	2.4	20279	7.1	80.4
ICHO	0	17535	6.1	86.5
WCHO	0.8	7935	2.8	89.3

The bedrock of the Sable Ecodistrict is mostly Meguma quartzite and slate. There are also extensive areas of granite in the western part of the ecodistrict, for example Spar Ridge. Soils are mostly moderately coarse, shallow and rocky. There are some extensive areas of coarse textured soil near Shelburne in the southwestern end of the ecodistrict. The well-drained sites can be somewhat dry during the growing season. Freshwater in lakes and rivers accounts for 5.9% of the total area of the ecodistrict.

On the well-drained hills and hummocks (WCHO) with coarse textured soils, a climax forest of red oak, white and red pine will occur. Where the soil becomes less coarse (WMHO), these ecosections will support a forest of red spruce, hemlock and white pine. About one-quarter of the ecodistrict is treeless bog, or supports a stunted black spruce forest. Better drained hummocks in the boggy areas support a forest of white pine and black spruce. About half of the ecodistrict is covered by imperfectly drained, moderately coarse soils. These ecosections have a climax forest of black spruce, with white pine on the upper slopes of hills and on better drained microsites. The poorly drained sites support a forest of stunted black spruce. A total of 2.2% of the ecodistrict is exposed bedrock.

770 - Flint Ecodistrict

The Flint Ecodistrict is located in the interior of western Nova Scotia. The topography, geology and soils are similar to the adjacent South Mountain (720), which surrounds the northern portion of the ecodistrict. The southern boundary is adjacent to the Sable (760) and Clare (730) ecodistricts. Its position in the interior of the province, away from the moderating influence of the ocean, means that summers are hotter and drier and winters are cooler than adjacent ecodistricts. Elevations reach about 200m. The total area of the ecodistrict is 790 km^2 or 5% of the ecoregion.

Ecosection	Rockland %	Area (ha)	% Ecodistrict	Cumulative %
ICHO	2.1	33854	42.8	42.8
WCHO	6.4	33623	42.5	85.3
ICSM	2.7	3995	5.1	90.4
PCSM	0	3243	4.1	94.5
WCKK	0	423	0.5	95.0

Like the adjacent South Mountain Ecodistrict (720), this area is comprised of a rolling till plain underlain by a massive granite batholith. Repeated fires in this ecodistrict have caused widespread barrens, which have been slow to regenerate tree species due to the frequency of the fires and the coarse, shallow and infertile soils. As well, many of the soils in this ecodistrict are characterized by a massive orstein layer (locally known as hardpan) which is impervious to water movement and significantly restricts rooting depth to a few centimeters below the surface. Much of the ecodistrict is carpeted with dense layers of ericaceous (heath) vegetation including huckleberry, rhodora and lambkill on drier sites and leatherleaf and Labrador tea on the wetter sites. The extensive root mat created by these shrubby, acid loving plants severely restricts regeneration of softwood species and only sparse stands of white pine and black spruce occur. Scrubby red maple and white birch occur

throughout the ecodistrict. If fire is removed from the disturbance regime for this ecodistrict, many of the better sites may revert to the tolerant hardwood and softwood associations as characterized by the few remaining old growth examples in the ecodistrict. However, Strang (1972) concluded that the factors which mitigate against profitable afforestation are such that other land use possibilities are equally circumscribed and that no useful purpose will be served by expensive efforts to plant trees which will grow only slowly at best. Freshwater lakes and rivers account for 4.9% of the ecodistrict. A total of 3.7% of the ecodistrict has exposed bedrock although this may seem low given the significant amount of large boulders scattered across the landscape giving the local name "flintstone theatre" to the area. Strang (1972) conclcuded that this area "with its complex of streams, lakes, bizarre terrain and seasonally spectacular vegetation might best be utilized as a wilderness area and ecological curiousity."

800 - Atlantic Coastal Ecoregion

Distinguishing Ecoregion Feature: *A coastal climate dominated by its proximity to the Atlantic Ocean and vegetation reflecting this climate.*

This ecoregion extends along the Atlantic coast of the province from Yarmouth to Scaterie Island. The Atlantic Coastal Ecoregion seldom exceeds five km in width, except along the Cape Breton shoreline where the coastal influence can extend almost 20 km inland. In areas where bays, coves and rivers are indented inland for several kilometers from the ocean, for example, Mahone Bay, Shelburne Harbour, and Country Harbour, the effect of the coastal climate can be reduced or eliminated. The inland boundary of the ecoregion is more defined by the absence of certain vegetational species than by a geo-physical attribute. However, in some portions of the ecoregion, rising uplands (Mira Hills) and coastal islands (Clam Bay to Liscombe Point) reduce the influence of the coast further inland. The underlying geology is quite varied because of the extent of this ecoregion. However, since most of it is comprised of the lower elevations of the tilting Appalachian peneplain, the bedrock is predominately granite, quartzite or slate on the mainland. The Chedabucto Bay area is underlain by carboniferous sedimentary rocks. Along the east coast of Cape Breton Island, older precambrian rocks underlie the ecoregion. The soils of the ecoregion for the most part are thin and stony. However, thicker tills are found where drumlins extend into the ecoregion. Particularly in the east, significant portions of the ecoregion are covered with deep organic soils that have developed on flat or level topography where drainage has been impeded and the cool moist climate has favoured the development of the peat material. In areas where deeper sandy materials occur, a hardpan formation (also known as an ortstein layer) will be found restricting drainage and creating thick humus layers under forest stands. The total area of the Atlantic Coastal Ecoregion is 5532 km^2 or 10 % of the province.

There is no disputing the impact of the Atlantic Ocean on the climate of the ecoregion. The most notable impact of the coastal influence is that the ecoregion has the longest frost-free period in the Maritimes. Provincially, the ecoregion has the mildest winter, but this is offset by a slow spring warm-up and the lowest number of growing degree days in Nova Scotia. Annual precipitation is 1400-1500 mm, the bulk of which falls as rain with only an estimated 15% occurring as snow. Overall, the ecoregion is exposed to high winds, high humidity, salt spray, and fog during the summer and fall. The movement and mixing of the offshore currents, the warmer Gulf Stream and the colder Labrador Current, contribute to the significant variation in weather patterns from year to year. The late arrival of warmer offshore currents in the fall impacts the growing season and frost-free period. Another impact that, perhaps, is not completely understood at this time is the consequences of the construction of the Canso Causeway on ice movement through the Strait of Canso into Chedabucto Bay.

The near absence of red spruce delineates this ecoregion from the adjacent Western and Eastern Ecoregions on the mainland. Only near Yarmouth and Lobster Bay (Tusket River Islands) can red spruce be found growing close to the coast. In the southwest, an indicator of the approximate inland boundary is the reappearance of red oak and white pine. White spruce is a common forest species on the most exposed sites in the Coastal Ecoregion, i.e. coastal islands and headlands, but becomes less abundant away from the water. Hardwood species take a subordinate role in the coastal forest with red maple and white birch common components of the understory of black spruce and balsam fir forests. Most notably on the nutritionally poor sites along the eastern shore, balsam fir will form dense stands with small diameters, an indication that site conditions do not allow self thinning. Much of the eastern portion is comprised of flat and raised bogs, fens and salt marshes. On sites with wet mineral soils, black spruce is the predominant tree species. Further east on the Canso peninsula, large barren rock outcrops are presently covered only with scattered conifers and ericaceous (heath) vegetation. Most of the ecoregion is susceptible to windthrown and the area has experienced significant forest losses from hurricanes such as the Saxby Gale (1869). Loucks (1961) reports that fires have been common in the ecoregion but they appear to have been started by European settlers to extend their pasture land. He states, however, that the presence of jack pine in several places on the Canso peninsula and on Isle Madame suggests that the constant winds may create a drought condition that is conducive to wildfire.

Ecodistricts of the Atlantic Coastal Ecoregion

810 - Cape Breton Coastal	*2013 km²*	*840 - Southwest Shore*	*791 km²*
820 - Eastern Shore	*1677 km²*	*850 - Sable Island*	*31 km²*
830 - South Shore	*1020 km²*		

810 - Cape Breton Coastal Ecodistrict

Extending along the north shore of Chedabucto Bay and along the coast of Cape Breton Island this is the widest coastal ecodistrict in the province. Including both sheltered and exposed ecosections, the coastal forest still dominates the vegetative cover of the area. The complexity of the underlying geology is masked by the dominance of the coastal climate. Since the construction of the Canso Causeway in 1953, there has been no movement of spring ice from the Gulf of St. Lawrence through the Strait of Canso where currents once flowed at 4.26×10^3 to 8.46×10^3 cubic metres per second from St. George's Bay (Fothergill, 1954). Spring ice still comes through Cabot Strait from the Gulf of St. Lawrence and then gets blown against the Cape Breton coast. The impact of this reduced quantity of offshore ice in the spring has yet to be determined, but it could be hypothesized that the extent of coastal forest in this ecodistrict is in response to the late cool, wet springs when ice remained offshore well into May. The total area of this ecodistrict is 2,013 km^2 or 36% of the ecoregion.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
IMHO	41725	20.7	20.7
WMKK	36838	18.3	39.0
WFKK	29984	14.9	53.9
WMDM	25815	12.8	66.7
WMHO	12885	6.4	73.1
IFHO	10991	5.5	78.6
IMDM	7587	3.8	82.4
WFHO	5155	2.6	84.9

Sedimentary rocks, such as siltstones, sandstones, shales and conglomerates, predominate on the Chedabucto north shore, Isle Madame and northeasterly to Loch Lomond. However, from Point Michaud to Scaterie Island the Forchu group of rocks (volcanic granites, rhyolites and andesite) as well as metamorphic sediments (slate and quartzite) underly a deep deposit of glacial till, sand and gravels with the underlying bedrock visible only along the coast. The glacial history of the Cape Breton portion of this ecodistrict includes various depths of glacial deposits and drumlins. Two dominant soils define the ecodistrict. On the north shore of Chedabucto Bay finer textured, well to imperfectly drained soils occur and extend to St. Peter's. From L'Ardoise to Mira Bay coarse, better drained soils are found, especially on the drumlins and elevated glacial deposits. However, several large areas of coarse textured, imperfectly drained soils will be found around the bays of Forchu and Gabarus and some poorly drained coarse soils occur at Little Lorraine. Lakes and rivers are significant within this ecodistrict, occupying 14,549 hectares or 7.2% of the ecodistrict.

The dominant forest of the Cape Breton Coastal Ecodistrict is the white spruce, balsam fir and black spruce mix which is so prevalent in Nova Scotia's coastal forests and extends several

kilometres inland. Species of the Acadian forest climax type start to appear as one moves inland from the coast. In sheltered areas occasional white pine will be noticed and tolerant hardwoods will be found on the drumlins. For the most part, however, red maple and white birch predominate the hardwood component of the coastal forests. These coastal forests are also subjected to serious wind damage and both stand level disturbances and/or small gap disturbances will occur. The absence of white pine, sugar maple and beech are usually strong indicators of a coastal influence.

820 - Eastern Shore Ecodistrict

Ecosection	Rockland %	Area (ha)	% Ecodistrict	Cumulative %
IMHO	5.2	36083	21.5	21.5
WMKK	8.1	26540	15.8	37.4
WCKK	66.4	25520	15.2	52.6
WCHO	37.1	12972	7.7	60.3
IMRD	14.0	10113	6.0	66.3
WMRD	38.7	8140	4.9	71.2
WMDM	0	6445	3.8	75.0
ICHO	22.0	5401	3.2	78.3
WMHO	13.7	5068	3.0	81.3

Starting on the east side of the Halifax peninsula and extending to the town of Canso, the Eastern Shore Ecodistrict spans a varied landscape of landforms, geology and soils. Nonetheless the influence of the Atlantic Ocean overrides these physical attributes to provide a consistent coastal climate reflected in the forests of the ecodistrict. In the west the ecodistrict is several kilometers narrower than in the east, where the coastal influence extends inward to encompass all of the Canso peninsula. For most of the ecodistrict, the influence of the ocean seems to extend inland until it reaches the 60 m contour except on the Canso peninsula, where coastal forests are found on elevations of 150 m. The total area of the ecodistrict is 1,677 km^2 or 30% of the ecoregion.

At both ends of the ecodistrict granite barrens define the boundaries and in-between are the greywackes and slates of the Goldenville formation. A variety of landforms occur across the ecodistrict. As one travels from the granite barrens of the Halifax peninsula eastward, sand beaches and dunes give way to a proliferation of offshore islands, often drumlin in origin, to the coastal headlands of Guysborough County and finally to the granite barrens of the Canso peninsula. Where the soils are well-drained and sheltered from the coastal environment, the

conditions for forest growth can be quite favourable for balsam fir. Lakes constitute a significant portion of the ecodistrict with 9,334 hectares or 5.6% of the ecodistrict covered in freshwater. Approximately 21.6% of the ecodistrict (36,350 hectares) is comprised of exposed bedrock, by far the greatest area of any ecodistrict.

The absence of red spruce in the coastal forest is a strong indicator of coastal climatic influence. Other species absent because of the coastal influence are white pine, sugar maple and beech. Hardwoods, such as white birch and red maple, may also be absent in the overstory but are usually present in an intermediate or suppressed canopy position in the forest stand. A typical coastal forest is comprised primarily of balsam fir, black spruce and scattered white spruce. Where exposure to the ocean is extreme a narrow shoreline band of white spruce will form a krummholz type forest with extremely stunted growth. On the more sheltered sites with deeper soils, especially in the east, balsam fir will predominate over the spruces. These short-lived (usually less than 100 years) coastal forests, are constantly being renewed by stand initiating disturbance agents such as blowdown, disease, insects and occasional fires. The moist climate is conducive to regeneration establishment by balsam fir and black spruce and most stands will have already established a layer of advanced regeneration during the break-up of the overstory (McCurdy et al, 2003).

830 - South Shore Ecodistrict

The South Shore Ecodistrict extends about 160 km along the Atlantic coast of Nova Scotia from the Halifax peninsula to the mouth of the Clyde River and extends inland approximately 10 km. The Clyde River watershed is also used to define the eastern boundary of the Gulf of Maine (Kelly 1999). The coastline is irregular, with many bays, inlets, headlands and islands. The climate of the South Shore is probably influenced by the warmer waters of the Gulf Stream more so than the Eastern Shore (820), which is cooled by the colder waters of the Labrador current before it deflects out into the Atlantic Ocean. The South Shore also shares the same topography and geology as the adjacent inland ecodistricts (720, 740, 750, 760) but is separated from them due to the impact of the coastal climate on biodiversity. Its location on the Atlantic coast means that the South Shore is cooler in summer and milder in winter than the adjacent inland ecodistricts, and fog is more common along the coast. The total area of the ecodistrict is 1,020 km^2 or 18% of the ecoregion.

The bedrock along the South Shore is mostly greywacke and granite. The soil is thin and moderately coarse-textured with imperfect to poor drainage. Sand beaches are common along the shoreline. Nearly 3% of the ecodistrict is covered with lakes and streams (3,056 ha).

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
IMHO	42007	41.2	41.2
WMHO	16567	16.2	57.4
PMHO	838333	8.2	65.6
IMSM	5768	5.7	71.4
WMDM	5716	5.6	77.0
WMRD	3626	3.6	80.5
IMRD	3486	3.4	83.9
WFDM	2668	2.6	86.6
WCKK	2629	2.6	89.1

Because the coast was the first part of Nova Scotia settled by Europeans, the forests have been extensively harvested for a variety of products. Black and white spruce predominate the coastal forest with scattered occurrences of balsam fir. The coastal headlands receive the brunt of the Atlantic winds, which creates coastal forests of spruce where the trees are severely stunted. However, once the impact of this exposure is diminished either by shelter from established spruce or distance from the coast, other tree species will establish in the ecodistrict although the thin soil can be a serious impediment. The absence of red spruce, except for the most sheltered locations in the ecodistrict, is usually an indicator of the coastal influence of the Atlantic Ocean. This ecodistrict excludes the inner islands of Mahone Bay which for the most part are within the LaHave Drumlin ecodistrict. The vegetation of the forest ecosystems on many of these islands was studied recently (SRES 2002). Red spruce and white pine with scattered sugar maple, yellow birch and hemlock were reported which indicates that these islands are afforded some protection from the Atlantic Ocean.

840 - Southwest Shore Ecodistrict

The Southwest Shore Ecodistrict includes the southern most part of Nova Scotia. The ecodistrict extends along the coast to Yarmouth Harbour where the Clare (730) Ecodistrict provides the northern limit. The Southwest Shore Ecodistrict has similar topography and geology to the adjacent ecodistricts (730,760) but can be separated from them due to the climatic influence of the Gulf of Maine. The ecodistrict has not been extended much past Yarmouth and along St. Mary's Bay since the coastal influence was determined to affect only a narrow band along this shore. The Southwest Shore Ecodistrict is made up of a submerged coastline with tidal rivers and inlets (Chebogue River), numerous islands (Tusket Islands) and saltmarshes. At any point the

ecodistrict seldom exceeds 10 km in width. Overall, the moderating effect of the Gulf of Maine gives this area the mildest winters in the province and a frost free period for over half the year, longer than any other place in Atlantic Canada. Yarmouth's average January temperature is -2.7 degrees Celsius, the warmest of any mainland station in the Maritimes. However, summers are cool and fog is common. The total area of the ecodistrict is 791 km^2 or 14% of the ecoregion.

The bedrock of the Southwest Shore Ecodistrict is mostly quartzite and slate. However, there is an intrusion of granite near Wedgeport. Soils are derived largely from glacial drift with a moderately coarse texture. An extensive area of salt marsh is found in this ecodistrict, comprising approximately 5,369 hectares or 6.8% of the ecodistrict. Another 3,523 hectares (4.5% of the ecodistrict) are classified as fresh water.

Forests in this ecodistrict have been heavily impacted by human activity. Black spruce is the dominant species along the shore, with white spruce and balsam fir. In areas where shelter is provided by topography, conditions are suitable for other species such as red spruce, white pine, red oak and tolerant hardwoods. Red spruce and white pine are the dominant species on well-drained sites with moderately coarse soil. The climax forest on hills and drumlins with well-drained, coarse-textured soils is red oak and white pine. The eastern limit of the ecodistrict occurs at the Clyde River. Coastal influence southwest of that point was considered to be from the Gulf of Maine instead of the Atlantic Ocean. The Gulf of Maine Working Group (Kelly 1999) use the Clyde River watershed as the southerly limit of the Gulf of Maine watershed. There appears to be a climatic influence associated with the Gulf of Maine, which allows the growth of red spruce and other tolerant species such as white pine, sugar maple and yellow birch. The continuance of these species along the shore to Cape Chignecto, around the Bay of Fundy and down the coast of Maine (Davis 1966) suggests that the coastal influence of the Gulf of Maine is moderate compared to that of the Atlantic Ocean.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
IMHO	27035	34.2	34.2
PMHO	8811	11.1	45.3
PMSM	7541	9.5	54.8
WMHO	6473	8.2	63.0
IMSM	6290	8.0	71.0
WCHO	5830	7.4	78.3
WMDM	3069	3.9	82.2
ICHO	2391	3.0	85.2

850 - Sable Island Ecodistrict

Situated on the continental shelf 300 km east of Halifax is Sable island, a shallow, crescent-shaped, 31 km^2 island that is exposed to constant winds, salt spray and blowing sand. The island is oriented east-west and consists of two lines of high dunes, less than 50 m wide, and it is approximately 42 km by 1.4 km at low tide. The climate on Sable Island is warmer in winter and cooler in summer than the Nova Scotia mainland, but it receives similar precipitation. There are no trees on the island and the vegetation consists mainly of sea-beach sandwort, beachgrass and beachpea. Several shrubs can be found, including bayberry, wild rose, black crowberry, cranberries and common juniper.

For a more detailed description of the geology, plant life and history of Sable Island a good reference is the Natural History of Nova Scotia, Volume 2 (1996).

900 - Fundy Shore Ecoregion

One of the smaller ecoregions, this narrow strip wraps around the Bay of Fundy starting at Cape d'Or to Five Islands before crossing over to Cape Split and continuing west to Brier Island. Although Loucks (1961), in his description of the forest regions, included an area from Cape Chignecto and along Chignecto Bay to Amherst, it appears that the high coastal headlands of this area reduce the impact of the Bay to a very narrow strip of land that is difficult to show at this level of mapping. A significant feature of the geological history of this ecoregion is the basalt lava which flowed from rifts created by the movement of the continental plates as they drifted apart over 200 million years ago. This basalt underlies the North Mountain and can be found on the north shore of the Minas channel and eastward to Portapique. The topography can be quite variable, with sharply dissected slopes coming down to the Bay or gently undulating to rolling coastal plains skirting the shores. The highest elevations along the North Mountain rise up to 225 m above sea level, whereas the Parrsboro shore elevation seldom exceeds 125 m above sea level. Much of the soils in this ecoregion are moderately coarse, commonly stony to gravelly, and shallow to bedrock and well drained. However, there are large areas of finer textured, imperfectly drained soils occurring in the ecoregion where farming has occurred. The total area of the Fundy Shore Ecoregion is 1219 km^2 or 2.2 % of the province.

The North Mountain bears the brunt of the weather coming off the cold waters of the Bay of Fundy, protecting the Annapolis-Cornwallis valleys from the cooler climate and the fogs of the Fundy shore. Summer temperatures are cooler and winters are somewhat milder than the interior of the province.

Distinguishing Ecoregion Feature: *A coastal climate dominated by its proximity to the Bay of Fundy.*

However, the cold waters of the Bay of Fundy tend to prolong the arrival of spring. Total annual precipitation is 1200-1400 mm and fog is frequent along the shores. A narrow band of coastal forest is found along the shore and is most notable on exposed cliffs. Here, white spruce predominates but gives away quickly to mixedwood forests of balsam fir, red spruce, red maple, white birch and yellow birch. Beech and sugar maple are found on the upper slopes and higher elevations. White pine and hemlock are present but more common on the inland slopes of the North Mountain and near the foothills of the Cobequid Mountains.

Ecodistricts of the Fundy Shore Ecoregion

910 - Parrsboro Shore	227 km^2
920 - North Mountain	989 km^2

910 - Parrsboro Shore Ecodistrict

On the north shore of the Minas Basin, stretching from Economy Mountain in the east to Cape Chignecto in the west, is a narrow ecodistrict with a varied geological history. Nestled up against the Cobequid Hills Ecodistrict (340) the Parrsboro Shore can be best characterized as a series of small rolling hills dissected by the steep-sided canyons of rivers and streams flowing from the Cobequid Mountains. Several outwash plains are interspersed with this topography, with examples at Parrsboro and Advocate. Overall, the elevation seldom exceeds 125 m above sea level, but the rapid descent to sea level affords the impression of a more significant rise. The local climate is significantly affected by the proximity to the cold waters of the Bay of Fundy. Summer temperatures are cool and fog is a common occurrence, even though hot and humid conditions may exist only kilometers away in Truro. The total area of the ecodistrict is 227 km^2 or 19% of the ecoregion. Isle Haute in the Bay of Fundy is included in this ecodistrict.

The area has three major faults running its length, with a series of minor faults throughout. This has created a varied landscape with resistant basalts and erodable sandstones side by side. The lowlands are underlain by soft sandstone but where it is capped by basalt, high, steep-sided hills like Economy Mountain are formed. Large glacial outwash plains can be found at Parrsboro and Advocate The predominant shale-derived, sandy loam soils cover the steep slopes from Five Islands to Advocate. On the lowlands, finer textured, imperfectly drained soils are found around Parrsboro. The outwash valleys are underlain with rapidly drained, coarser textured soils, often with a high content of gravel. Most of the freshwater in the ecodistrict occurs primarily in fast flowing, narrow streams and rivers running off the Cobequids. The total freshwater area is 265 hectares or 1.2% of the ecodistrict.

Coastal forests of white spruce skirt the headlands along the Minas Basin, but they quickly revert to tolerant hardwoods and softwoods a short distance from the shore. Red spruce is the dominant softwood and will be associated with hemlock and white pine on the hummocky ecosections. Those ecosections with coarse textured, well-drained soils, and usually occurring on the slopes of hills and steeper hummocky terrain, will be dominated with forests of tolerant hardwoods such as beech, yellow birch and sugar maple. Adding to the complexity, both tolerant softwoods and hardwoods grow together on the moister, finer textured soils. Only in the steep-sided ravines will predominantly softwood forests of the tolerant species be found. Wind throw appears to be the dominant stand disturbance, although the spruce budworm has created large areas of even-aged spruce forests.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMKK	4444	19.5	19.5
IFKK	2874	12.6	32.1
IFHO	2741	12.0	44.1
WCKK	2483	10.9	55.0
WCSM	2371	10.4	65.4
WCHO	2257	9.9	75.3
WFKK	1720	7.6	83.9
IFSM	999	4.4	87.3
ICHO	720	3.2	90.5

920 - North Mountain Ecodistrict

The North Mountain Ecodistrict is a narrow ridge parallel to the shoreline of the Bay of Fundy. It stretches for about 200 km, from Cape Blomidon to Brier Island. At the southwestern end, it is broken to form Digby Gut, Digby Neck, Long Island and Brier Island. A maximum elevation of about 240 m is attained. The North Mountain is the northern boundary of the Annapolis Valley Ecodistrict (610) and serves to shelter the valley from the cold waters of the Bay of Fundy. The south facing slope of the North Mountain can be quite steep in places, with escarpment-like features at several locations. Small steep-sided valleys, locally known as vaults, dissect the slope. On the Bay of Fundy side, the slopes are longer and more gradual, but usually end with vertical cliffs at the coastline as at Cape Split, Margaretsville and Keatings Sand Beach. The total area of the ecodistrict is 989 km^2 or 81% of the ecoregion.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMHO	55681	56.3	56.3
WMKK	15350	15.5	71.8
WMDS	9823	9.9	81.7
WFHO	7517	7.6	89.3
IMHO	5098	5.2	94.5

The North Mountain is a ridge of basalt. Soils are mostly moderately coarse and well-drained. Although the soil is stony, extensive areas on the north slopes are suitable for agriculture and can be used for growing vegetables and forage. Apple orchards extend up the south facing slopes. Most of the forest has been heavily harvested over the centuries and the current forest is a mixture of intolerant hardwood species, white spruce and balsam fir, with scattered occurrences of red spruce and white pine. Some of the less accessible sites near Cape Split and in the vaults suggest that the climax forest consisted of both tolerant hardwood and softwood species. The total freshwater area is 372 hectares or 0.4% of the ecodistrict.

On well-drained sites along the Fundy Shore, white spruce is the dominant tree species with black spruce on the wetter sites. A short distance inland, usually less than half a kilometer, red spruce will occur on the lower and middle slopes of the North Mountain while sugar maple and yellow birch are found on the upper slopes and crests. Beech was probably abundant at one time, but has been reduced to an understory species in most of the tolerant hardwood stands. However, there are still extensive areas on the steep slope overlooking the valley where beech, mostly low quality, is a dominant species. An example can be seen at the provincial park outside of Bridgetown. The vaults on the Fundy side support a varied forest with tolerant hardwoods, red spruce and a few white pine on the upper slopes. Shaded and lower slope of the vaults are red and black spruce and a few hemlocks. One of Nova Scotia's rarest native trees, white cedar, grows in a few locations near the southwestern end of the mountain.

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Web Sites of Interest

Climate:	http://www.atl.ec.gc.ca/climate/index.html
Geology:	http://www.gov.ns.ca/natr/meb/pubs/pubs3.htm#maps
Landscape:	http://sts.gsc.nrcan.gc.ca/clf/landscapes.asp
	http://www.gov.ns.ca/natr/meb/field/start.htm
Natural History:	http://www.ednet.ns.ca/educ/museum/mnh/index.htm
Soils:	http://res.agr.ca/cansis/nsdb
Wetlands:	http://www.gov.ns.ca/natr/WILDLIFE/wetlands/page0.htm
Wildlife:	www.gov.ns.ca/natr/wildlife/genstatus/

Appendix I. Climatic Data for Nova Scotia's Ecodistrict (modified from Webb and Marshall,1999; Dzikowski et al., 1985; Environment Canada, 1997)

Ecoregion/Ecodistrict	Annual Precipitation (mm)	Growing Degree Days	Growing Season (days)	Mean Annual Temp. (C)	Mean Summer Temp. (C)[1]	Mean Winter Temp. (C)[2]
100 Cape Breton Taiga	1503+	1535	190-	6	16.7	-4.2
210 Cape Breton Highlands	1493+	1564	196-	6	16.7	-4.2
220 Victoria Lowlands	1676	1651	195	6.1	16.8	-4
310 C.B.Hills	1470	1538	192	6	16.6	-4.4
320 Inverness Lowlands	1377	1675	191	6.1	16.7	-4.1
330 Pict/Ant Highlands	1409	1521	192	5.4	16.6	-5.9
340 Cobequid Hills	1182	1524	195	5.5	16.5	-5.8
350 Cobequid Slopes	1373	1506	193	5.4	16.5	-5.9
360 Mulgrave Plateau	1528	1582	197	6	16.7	-4.5
370 St.Mary's River	1373	1506	193	5.4	16.5	-5.9
380 Central Uplands	1373	1506	193	5.4	16.5	-5.9
410 Rawdon\W'burg	1465	1591	196	5.9	16.8	-5.2
420 Eastern Drumlins	1440	1522	196	5.8	16.3	-5
430 Eastern Granite Up.	1440	1522	196	5.8	16.3	-5
440 Eastern Interior	1440	1522	196	5.8	16.3	-5
450 Governor Lake	1440	1522	196	5.8	16.3	-5
510 Bras d'Or Lowlands	1502	1512	193	5.8	16.4	-4.5
520 St.Georges Bay	1294	1660	194	6	16.7	-3.8
530 Northumberland L.	1128	1587	193	5.5	16.9	-6.1
540 Cumberland Hills	1193	1534	195	5.5	16.4	-6
550 Tantramar Marshes	1128	1587	193	5.5	16.9	-6.1
560 Chignecto Ridges	1193	1534	195	5.5	16.4	-6
610 Annapolis Valley	1183	1702	205	6.6	17.4	-4.4
620 Minas Lowlands	1250	1542	197	5.7	16.4	-5.6
630 Central Lowlands	1265	1621	198	6.1	17	-5
710 Valley Slope	1350	1663	203	6.5	17.2	-4.3
720 South Mountain	1350	1663	203	6.5	17.2	-4.3
730 Clare	1332	1582	210	6.9	16	-2.6

Ecoregion/Ecodistrict	Annual Precipitation (mm)	Growing Degree Days	Growing Season (days)	Mean Annual Temp. (C)	Mean Summer Temp. (C)[1]	Mean Winter Temp. (C)[2]
740 LaHave Drumlins	1441	1704	204	6.6	17.4	-4.4
750 Rossignol	1470	1731	210	7.1	17.4	-3.3
760 Sable	1426	1612	210	6.9	16.4	-2.9
770 Flint	1350	1663	203	6.5	17.2	-4.3
810 Cape Breton Coastal	1464	1604	190-	5.9	16.2	-4.1
820 Eastern Shore	1426	1447	195	5.8	14.8	-3.7
830 South Shore	1534	1827	205	5.6	17.4	-3.2
840 Southwest Shore	1238	1337	210+	6.4	13.2	-1
910 Parrsboro Shore	1250	1542	197	5.7	15.7	-5.8
920 North Mountain	1234	1584	207	6.6	16.3	-3.4

[1] Average for June, July, and August.
[2] Average for December, January, and February.

Inverness Lowlands is determined from Canadian Climate Normals (CCN) for Cheticamp station.
Victoria Lowlands is determined from Canadian Climate Normals (CCN) for Ingonish Beach
St. Georges Bay is from Canadian Climate Normals (CCN) for Port Hood and Dept. of Agriculture & Marketing (DAM) report for Antigonish
Sable is an average of Webbs 514 & 515
Parrsboro Shore is from CCN for Parrsboro and Alma, NB.