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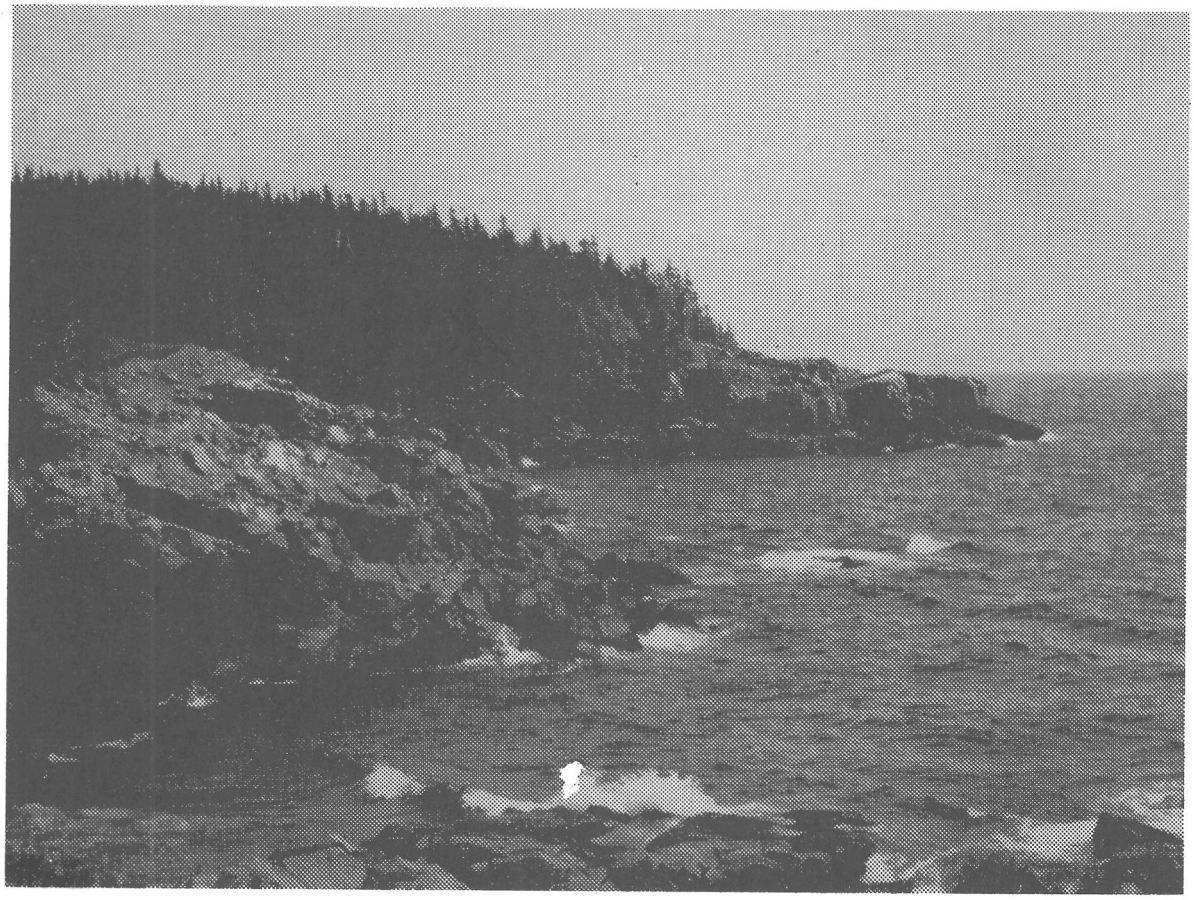

Ecological Land Classification
Fortress of Louisbourg National Historic Park

Volume 1 Report

March 1980

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ECOLOGICAL LAND CLASSIFICATION OF LOUISBOURG NATIONAL HISTORIC PARK

by

Harry Hilvonen
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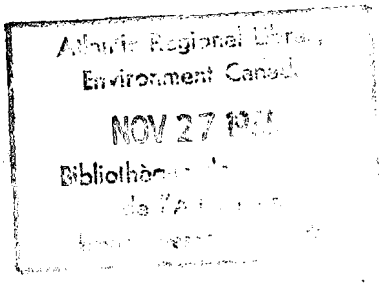

Lands Directorate
Atlantic Region
Environment Canada

for

Parks Canada
Atlantic Region
Environment Canada

March 1980

ACKNOWLEDGEMENTS

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ABSTRACT

The physical and biological characteristics of the Fortress of Louisbourg National Historic Park are described in terms of ecosites, with each ecosite depicting particular soil conditions, parent materials and plant communities. For overall park planning purposes these ecosites are categorized into three ecosections. These ecosections are described as to their general biophysical characteristics and are given a park perspective for environmental planning purposes.

ECOLOGICAL LAND CLASSIFICATION

OF

LOUISBOURG NATIONAL HISTORIC PARK

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1.0 Introduction

The protection of historic resources is Parks Canada's objective for the National Historic Parks. Significant scientific, ecological or aesthetic natural features however, may be preserved and managed as long as it does not seriously disturb the authentic historic environment.

It is within this scope that a natural resource base description of Fortress of Louisbourg National Historic Park was initiated during the fiscal year 1978-79.

The project is aimed at providing the Park with a useful, comprehensive and integrated description of the natural resources for the protection of sensitive resources and outstanding features, as well as resource value areas. To provide a functional and flexible framework for guiding the monitoring and management of the natural resources of interest was also an objective to achieve.

Lands Directorate, Atlantic Region, on behalf of Parks Canada, carried out the project. It consisted of a compilation, synthesis and analysis of available information, supplemented by field investigations to re-adapt an existing ecological map of the Park.

The report presents an holistic view of the natural resources of Fortress of Louisbourg National Historic Park. The ecosystems which characterize the Park are described and their significance discussed within the framework of an ecological classification.

2.0 Description of Environmental Components

2.1 Physical Component

2.1.1 Geographic Location

The Fortress of Louisbourg National Historic Park is the largest Historic Park in Canada covering close to 6000 ha. Situated near the town of Louisbourg in Cape Breton, Nova Scotia, it is approximately 40 km. from the city of Sydney and nearly 470 km from Halifax (Figure 1).

The historic site of the French fortress of Louisbourg is located on the southern shores of Louisbourg Harbour. The Park itself extends eastwards from Louisbourg to include the coastal lands from Lighthouse Point to Lorraine Head. To the west, the Park extends from Louisbourg Harbour to Deep Cove in Gabarouse Bay. The northern limits cut through the northern end of Kelly Lake, to encompass Mathieson Lake and to border Twelve Mile Lake at the northwestern extremity.

2.1.2 Climate

The Park is located on the Atlantic coast and, as such, its climate is influenced greatly by the prevailing marine environment. Coastal fog is common with summer high temperatures averaging a relatively cool 20°C. Average annual precipitation exceeds 1350 mm with May to September rainfall averaging 470 mm. The wettest month is usually August with an average rainfall of 100 mm over the past few years. Annual snowfall accumulation averages between 150 and 200 cm. Prevailing winds are from the southwest. Thus, much of the coastline is characterized by choppy seas. Except for the calmest of days, calm nearshore waters in the morning are often rough by mid-day.

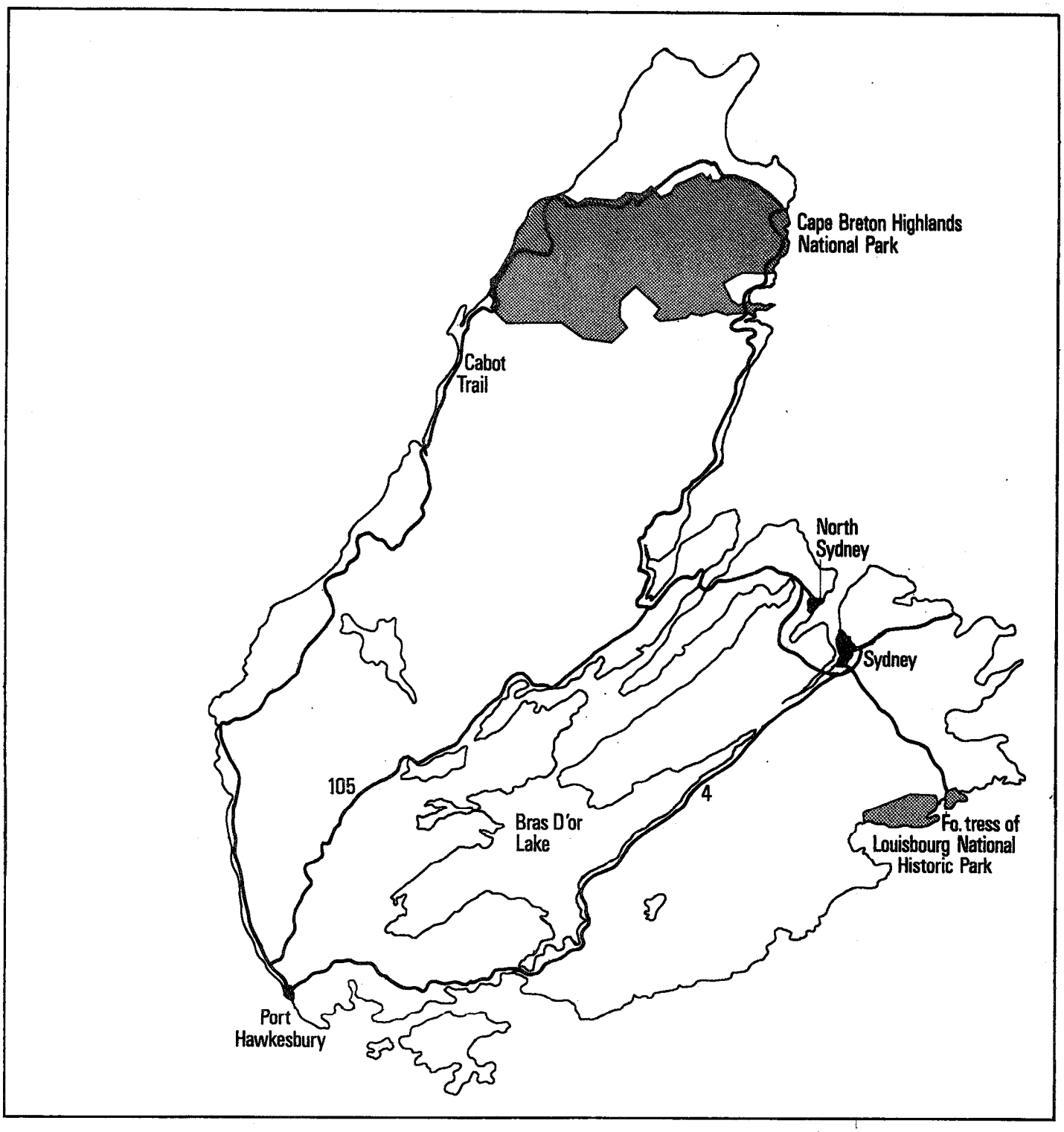


Figure 1 **Fortress of Louisbourg National Historic Park in relation to major centers of Cape Breton**

The frost-free period along the Cape Breton coast approximates 180 days whereas, inland, depending on altitude, the frost-free period varies between 140 - 160 days. Frost is common in October and may extend into late May.

A good indicator of prevailing climatic conditions for plant growth is soil climate. Soil climate relates to aerial climate, but the responses are affected in time and degree by the water content of the soil, its depth, surface cover, landscape position and by man's manipulation. These interactions are often indirect, complex and difficult to evaluate. The Soil Climate Map of Canada (Agriculture Canada, 1977) classifies the Louisbourg area as moderately cold cryoboreal. Thus, the growing season (when the average temperature is greater than 5°C is normally less than 220 days. Growing season degree-days are between 1100 and 1250. This represents the number of degrees above 5°C each day during the active growing season from May to September. These figures compare favourably with Cape Sable in southern Nova Scotia where less than 1000 degree-days are recorded. In contrast, the Annapolis Valley and Northumberland Shore have 1400 degree days.

2.1.3 Physiography

Canada is divided into seven major physiographic regions (Bostock, 1970). The largest of these is the Canadian Shield comprising a massive old surface of Precambrian rock covering almost half of Canada. To the east of the Shield is the Applachian Region that covers Atlantic Canada. The Appalachians form an extensive and complex belt of old mountains consisting largely of flat-topped rolling uplands, the main

axis of which runs northeast-southwest. Most of mainland Nova Scotia and the lands south of the Bras d'Or Lakes on Cape Breton Island fall within the Atlantic Uplands of Nova Scotia physiographic division of this Region. These Uplands lie along the entire southeast coast for some 560 km and contain small irregular lowland areas on Cape Breton Island. The lands of the Historic Park itself are characterized by undulating to strongly rolling topography consisting of shallow soils over bedrock interspersed by bogs in depressional areas. The highest point of land occurs north of Deep Cove where the local elevation approximates 117 m above sea level (a.s.l.). Elsewhere, elevations do not exceed much over 90 m a.s.l. Much of the upland area of the Park east of Louisbourg lies below 30 m a.s.l with the highest point being 43 m a.s.l.

The coastline is rocky and rugged with much of it being characterized by cliffs that average 15 m in height. The only significant sandy beach within the Park is found at Kennington Cove.

2.1.4 Bedrock

Canada is composed of seventeen geological subdivisions or "provinces" (Douglas, 1970). The Atlantic Provinces fall into the sub-division known as the Appalachian Orogen. The bedrock is 500 million years old. When compared to the Precambrian Shield with rocks formed 2500 - 3000 million years ago, this province is relatively young. However, it is older than the Continental Shelves where sediment and volcanic accumulations are less than 200 million years old and where present accumulations are occurring along the margin of the continental mass.

With respect to the Louisbourg environs in particular, much of the east coast of Cape Breton south of Mira Bay is dominated by Cambrian bedrock known collectively as the Fourchu Group. This Group consists of bedrock mainly of volcanic origin with inclusions of some sedimentary rock. Volcanic brecchias, varying in composition from acidic to basic and containing fragments up to several inches in length constitute the most abundant rock type; waterlain tuffs, fine grained, grey shale and sandstone are interbedded with them.

Most of the bedrock was formed during the Proterzoic era of the Cambrian period some 500 million years ago (Figure 2). The largest concentration of younger rock occurs at Deep Cove along the shores of Gabarouse Bay where Lower Devonian granites and allied rocks (deposited nearly 350 million years ago) may be found. These formations are being actively surveyed for economic mineral content.

2.1.5 Surficial Deposits

Some 12,000 to 15,000 years ago during the Pleistocene period, Nova Scotia was engulfed by ice. Much of the preglacial surface was scoured and subsequently covered with a layer of morainal deposits of varying thickness. In many places, over the years natural erosion has reduced this surface mantle to a veneer. Extensive morainal deposits do not occur over much of western Cape Breton. The deeper till accumulations may be found largely restricted to the eastern half of the Island.

Local striations between Gabarouse and Louisbourg give indication to a northeastward advance of the ice

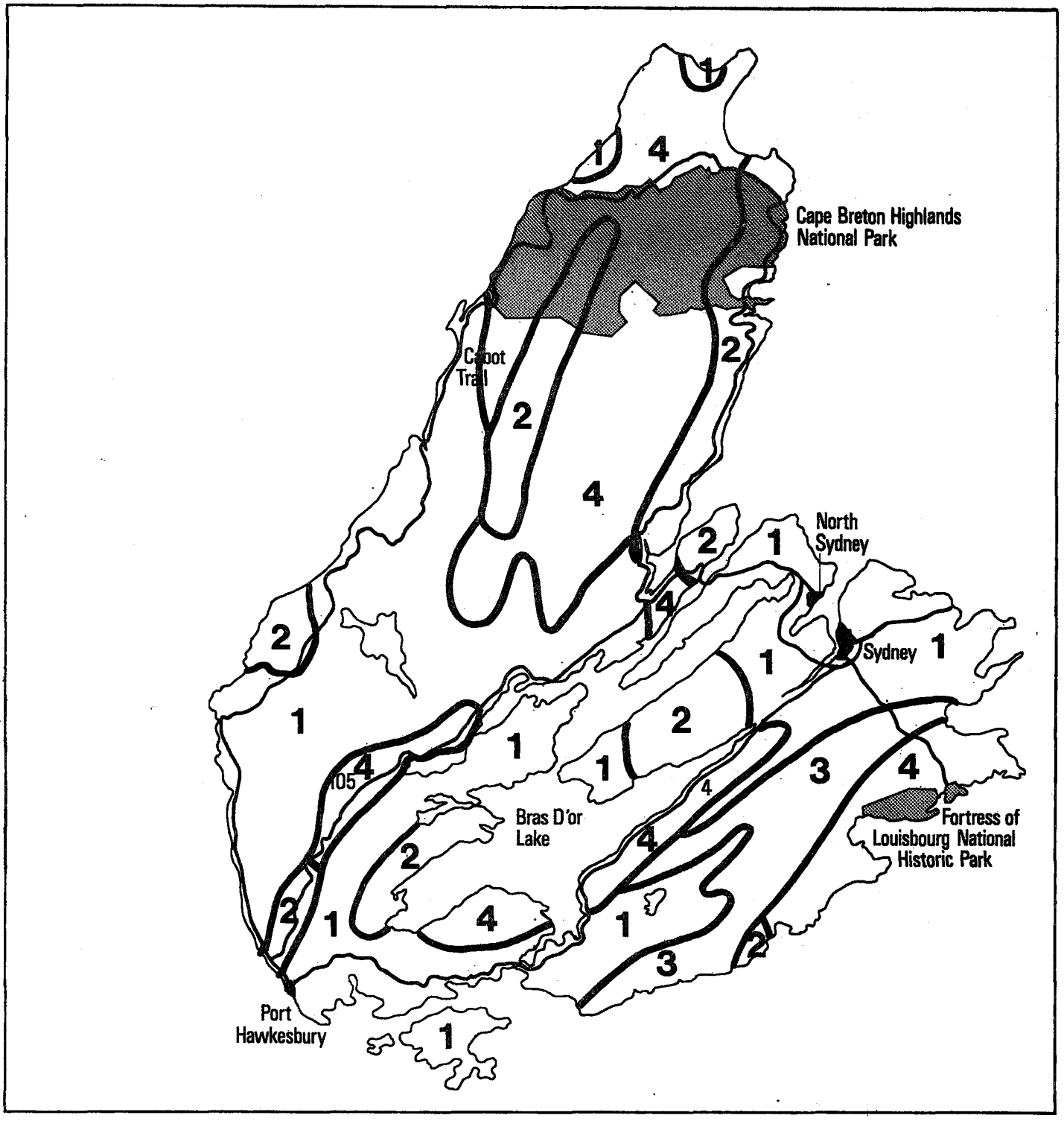


Figure 2 **Generalized Geology of Cape Breton (Modified after Douglas, 1970)**

1 Carboniferous (≈ 300 million years old) sedimentary and volcanic formations

2 Devonian (≈360 million years old) granites and allied plutonic formations

3 Cambrian (≈530 million years old) sedimentary and volcanic formations

4 Hadrynian (> 600 million years old) sedimentary and volcanic formations

during the last glaciation. Grant (1972) suggests that this ice flow appears to have emanated from an ice dome centered south of Cape Breton on the continental shelf. The depositions from this flow remain largely as shallow till cappings over the bedrock. Much of the till is very stoney and tends to be pale brown to greyish brown in colour with a sandy loam texture (Cann & MacDougall, 1963).

Throughout the uplands within the Park, sphagnum bogs are common in depressional areas. Fluvial depositions occur along the floodplains of the larger water courses such as Kennington Cove Brook and Landing Cove Brook. There is minimal occurrence of glaciofluvial sand and gravels. Except for coastal beach formations no exposed marine sediments occur within the Park.

2.1.6 Soils

The soils of the Louisbourg area are developed largely from sandy loam till. They are well-drained to poorly-drained, of sandy loam texture and show podzolic development (Figure 3). Under podzolization the upper mineral soil surface is leached and often appears ash white. The leached minerals, oxides of iron, aluminum and magnesium, accumulate below this layer forming a thin rusty red coloration which grades to brownish and greyish tinges as the parent material is reached.

According to Cann and MacDougall (1963), three soil series dominate within the Park lands: Thom, Mira and Arichat. As well, peatlands are common throughout the undulating uplands of the Park. The Thom soils have developed from a greyish-brown,

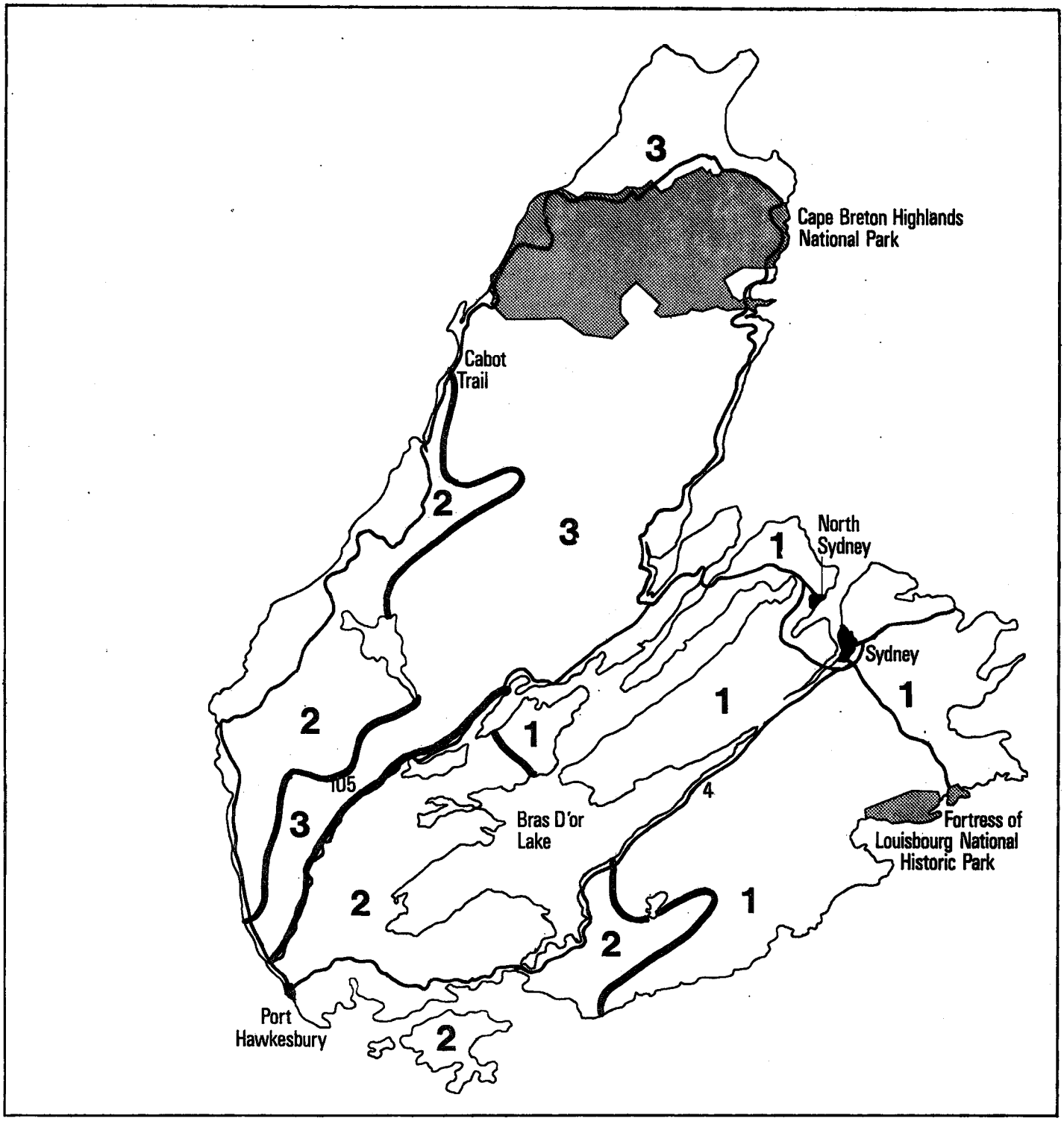


Figure 3 **General soil groupings within Cape Breton (Clayton, J.S. et al, 1977)**

1 Predominately podzolic soils with poorly drained associates

2 Predominately luvisolic soils

3 Predominately podzolic soils with significant areas of shallow soils

sandy loam till. They are moderately well-drained and have a characteristic dark coloured B horizon due to the accumulation of organic matter within this horizon. Under the Canadian Systems of Soil Classification (Agriculture Canada, 1978) these soils may be placed in the Ferro-Humic Podzol Great Group with the orthic ferro-humic podzol being the dominant subgroup.

Mira soils are associated with the Thom series. They are derived from similar parent materials except that, due to topographic position, water movement through the soil is restricted to some extent resulting in imperfectly drained conditions. The presence of mottles within the soil profile reflects this impeded water movement. The soils have a sandy loam texture and may be stoney. These soils are also part of the Ferro-Humic Podzol Great Group with the gleyed ferro-humic podzol being the dominant subgroup.

Arichat soils represent the poorly drained mineral soils within the Park. They are found interspersed throughout the Thom and Mira soils. Topography, bedrock, or the compactness of the underlying till may restrict the downward movement of water through the soil. These soils are strongly mottled, have a sandy loam texture and may be very stoney. Often these soils are shallow with bedrock occurring within 25 - 30 cm below the surface. These soils have the general properties specified for the Ferro-Humic Podzol Great Group and may be considered as gleyed ferro-humic podzols, although, unlije the Mira soils, they are poorly drained and are akin to the Gleysolic soils. If a podzolic B horizon is not evident, the

soils may be classified, in fact, as Orthic Gleysols within the Gleysol Great Group.

Near the coast, the soils in places tend to be more peaty on the surface and have a darker B horizon than is characteristic of ferro-humic podzols. These Humic Podzols are commonly developed under heath or under forest with a heath or sphagnum undergrowth. The dark B horizon is the result of an accumulation of organic matter leached from the surface. Some of the podzol profiles have a well-developed cemented iron layer in the B horizon. These thin "placic" layers are hard, impervious often vitreous and dark reddish brown to black. Placic horizons are generally cemented by Fe and Al-organic complexes.

The peatlands consist of soils of the Organic order. They include most of the soils commonly known as peat, much or bog soils. These soils are generally saturated with water for prolonged periods and occur widely in poorly and very poorly-drained depressions and level areas. Most of the bogs around Louisbourg have soils representative of the Mesisol Great Group. Fibrisols often occur in peat deposits dominated by sphagnum moss. Mesisols represent soils at a stage of decomposition beyond Fibrisol but not at an advanced stage of decomposition.

2.1.7 Water

The Historic Park has six sizeable lakes within its boundary. These lakes include Mathieson, Kelly, Cavanagh, Munroe, Spectacle, and Twelve Mile. Twelve Mile lake, situated along the northwestern boundary is the largest of these lakes. Most of the inland

ponds are associated with the major drainageways of the Park. During periods of heavy runoff, the streams spill their banks and replenish these overflow-ponds. Most of these ponds have standing water throughout the year. Along the coast small ponds, replenished by seepage and surface flows, occur in scattered depressional areas.

Artificial lagoons are found adjacent to the site of the Fortress. During fortress construction in the colonial days, sea walls were built that effectively cut off sections of sea water from the sea. A natural beach barrier has effectively closed the coastal pond near Lighthouse Point from the sea. This natural barrier however, is breached during the storm surges when the sea water totally inundates the pond.

Three major streams drain the Park: Kennington Cove, Gerard and Landing Cove Brooks. Kennington Cove Brook drains both Twelve Mile and Mathieson Lakes and flows into the sea at Kennington Cove. Landing Cove Brook has origins north of the Park and drains Cavanagh Lake. It empties into the sea east of Simon Point. Gerard Brook drains the northeast corner of the Park including Kelly Lake. It flows easterly into Louisbourg Harbour.

Several small streams drain local uplands. An unnamed stream drains both Spectacle and Munroe Lakes and flows into the sea half way between Deep Cove and Kennington Cove.

2.2 Biological Component

2.2.1 Vegetation

From a national perspective, the Park falls within the Acandian Forest Region, one of eight vegetation Regions that comprise all of Canada (Rowe, 1972). This Region, in particular, covers a total area of approximately 116,505 km and includes all of the lands of the Maritime Provinces south of the Chaleur Uplands of New Brunswick. Loucks' (1962) Forest Classification for the Maritimes puts the Park within his Atlantic Shore Ecoregion, a Region extending along the Atlantic Coast of Nova Scotia (Figure 4). In both classifications, these "Regions" consist of large areas of apparently stable vegetation bearing a predictable relationship to regional climatic and physiographic conditions. These regional characterizations refer to the potential natural vegetation that would exist if man's influence were removed. As well, specific site conditions may give rise to plant species or association of species abnormal to the overall vegetation of a specific region.

Accordingly, for a relatively small study area, such as the Fortress of Louisbourg Historic Park, local climatic and terrain conditions, as well as past cultural patterns must be analyzed to provide an insight into the composition of the present vegetation. The Louisbourg area, for example, is part of the Acadian Forest Region which is characterized by the presence of red spruce, white pine, eastern hemlock, yellow birch and other eastern eastern hardwoods. Yet, Cape Breton's eastern shore is notable for the absence or scarcity of these

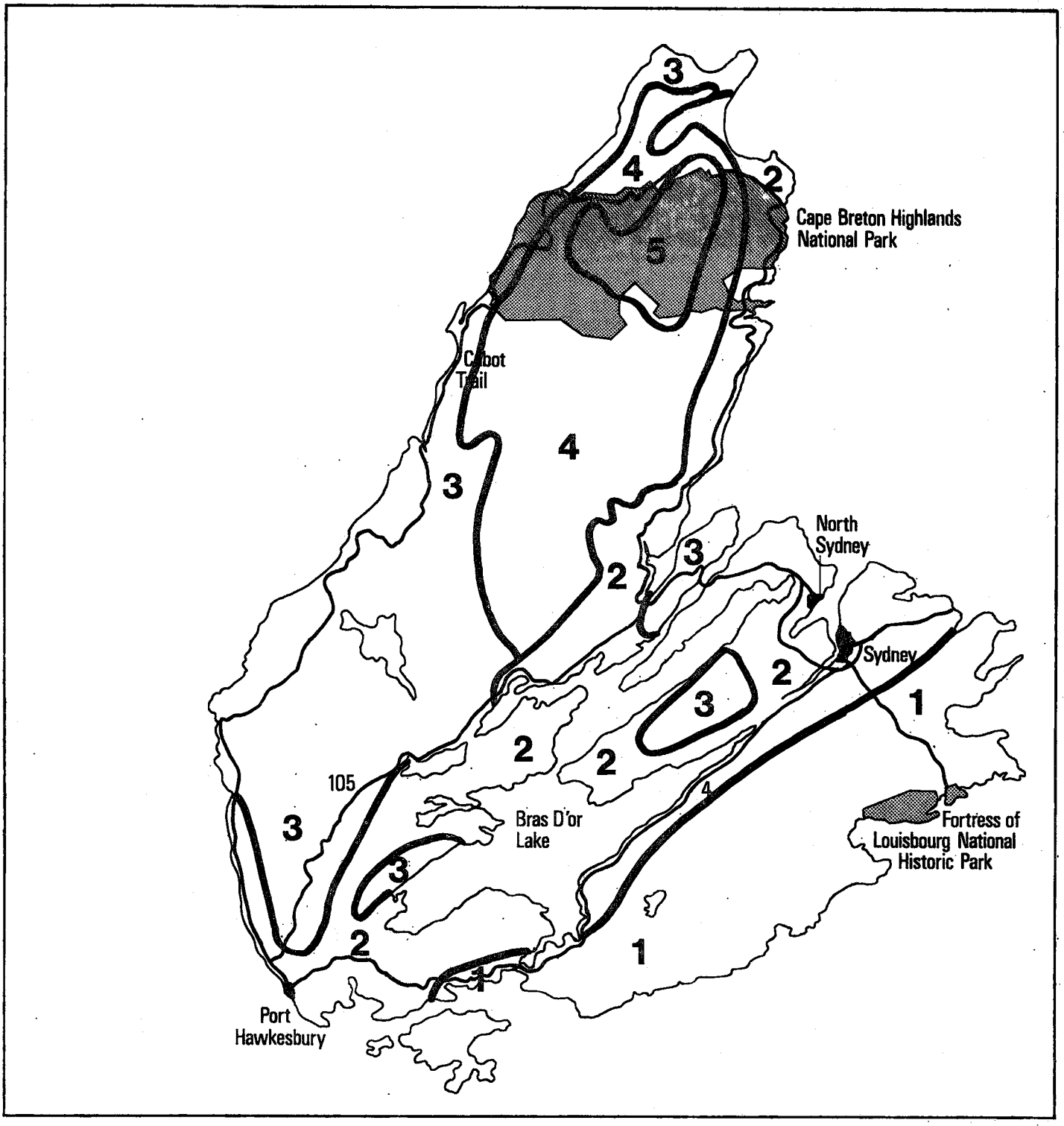


Figure 4 **Forest Regions of Cape Breton Island (Loucks, 1962)**

1. Atlantic Shore Ecoregion/Eastern Shore District
2. Restigouche — Bras D'or Ecoregion/Guysborough — Bras D'or District
3. Maritime Uplands Ecoregion/Cape Breton Hills District
4. Gaspe — Cape Breton Ecoregion/Cape Breton Highland District
5. Cape Breton Plateau Ecoregion/Cape Breton Plateau District

diagnostic species. Rowe recognized this anomaly by placing the eastern shore within a subdivision of the Acadian Region - the East Atlantic Shore Forest Section, the boundaries of which closely follow Louck's Eastern Shore District.

Thus, the Park and surrounding lands are notable for the lack of many tree species that are common throughout much of the Maritimes. This is a direct result of local climatic conditions and, in part, to past cultural activity. Eastern hemlock and white pine have a scattered occurrence around the Louisbourg area today; whereas, both species at the turn of the eighteenth century were more conspicuous. Since climatic conditions have not changed appreciably in the last three hundred years (not enough to substantially alter the forest tree cover), one wonders whether hemlock and pine were preferred species by the first settlers. Balsam fir, white birch, black and white spruce and alder were common constituents of the pre-settlement days as they are today.

As one proceeds inland from the coast, the lessened effects of exposure and salt spray are reflected in stand composition. White spruce, tolerant of salt spray, is common along the coast especially as a colonizer of old fields. Black spruce is ubiquitous inland and only occurs in sheltered sites along the coast. Dense, low-lying shrubs such as crowberry and the small cranberries survive along the most exposed coastline. Inland, the ground cover is diverse with a myriad of vascular plants being present. Balsam fir is the dominant tree species throughout the Park. However, red

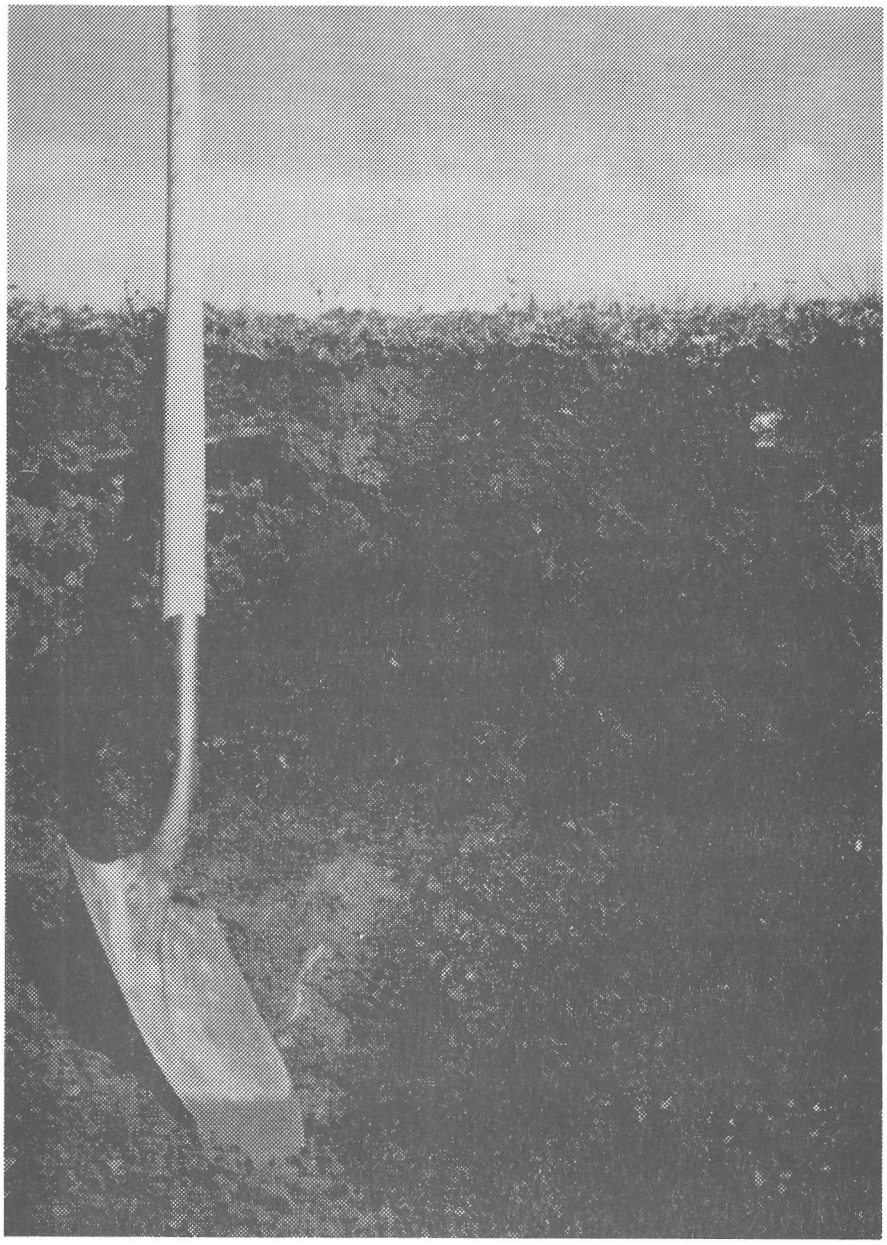


Figure 5 A ferro-humic podzol along the coastal ecosection of the Park. These soils are common under the heath and forest vegetation within the Park.

maple and white birch assume prominence along the inland ridges. Larch occurs on poorly-drained sites in close association with alder. Bogs are plentiful and vegetation is characterized by various sphagnum mosses along with leather leaf, Labrador tea, sheep laurel and bog cranberry.

Tree species present, but widely scattered, include sugar maple, yellow birch, trembling aspen, pin cherry and mountain-ash.

2.3 Cultural Component

The site of the Fortress of Louisbourg and its environs were settled by the French in the early 1700's. In 1719 they began to construct at Louisbourg a fortified town. During the early to mid 1700's this maritime sentinel welcomed ships from all the sea lanes of the North Atlantic. As a fishing port, naval base and centre of commerce, Louisbourg's importance far outweighed the towns and trading posts isolated in the centre of the continent.

The fortress town flourished for 45 years and then it was captured by the British in the sieges of 1745 and 1758. The town was well fortified for an attack from the sea. However, it was poorly located for an overland assault. The British landed near the beaches at Kennington Cove and set up encampments inland of the Fortress. In 1745 the Fortress was captured within 46 days. Three years later the town was restored by the Treaty of Aix-la-Chappelle to the French. In 1758, France and England were again at war and General James Wolfe captured the Fortress in seven weeks.

The Fortress walls were systematically demolished by the British in 1760. The town was abandoned and for over a hundred years remained as little more than a series of desolate grassey mounds. In 1928 the Canadian Government

declared the area as a National Historic Site and in 1976 the Park was established.

These surrounding lands basically encompass the sites where the British encampments occurred. Remnants of these encampments can be found, for example, along Landing Cove Brook (Freshwater Brook). The abandoned farm fields are what remain of the agricultural activity of the early to mid 1900's. Much of the Park lands have been logged two or three times over the years. All logging ceased once the Historic Park was established. Several logging roads exist within the Park and remnant logged patches are plainly visible from the air.

Figure 6 This abandoned farm land at Lorraine on the east side of the Park is dominated by Angelica, a plant introduced by the colonists.

3.0 Ecological Units of the Park

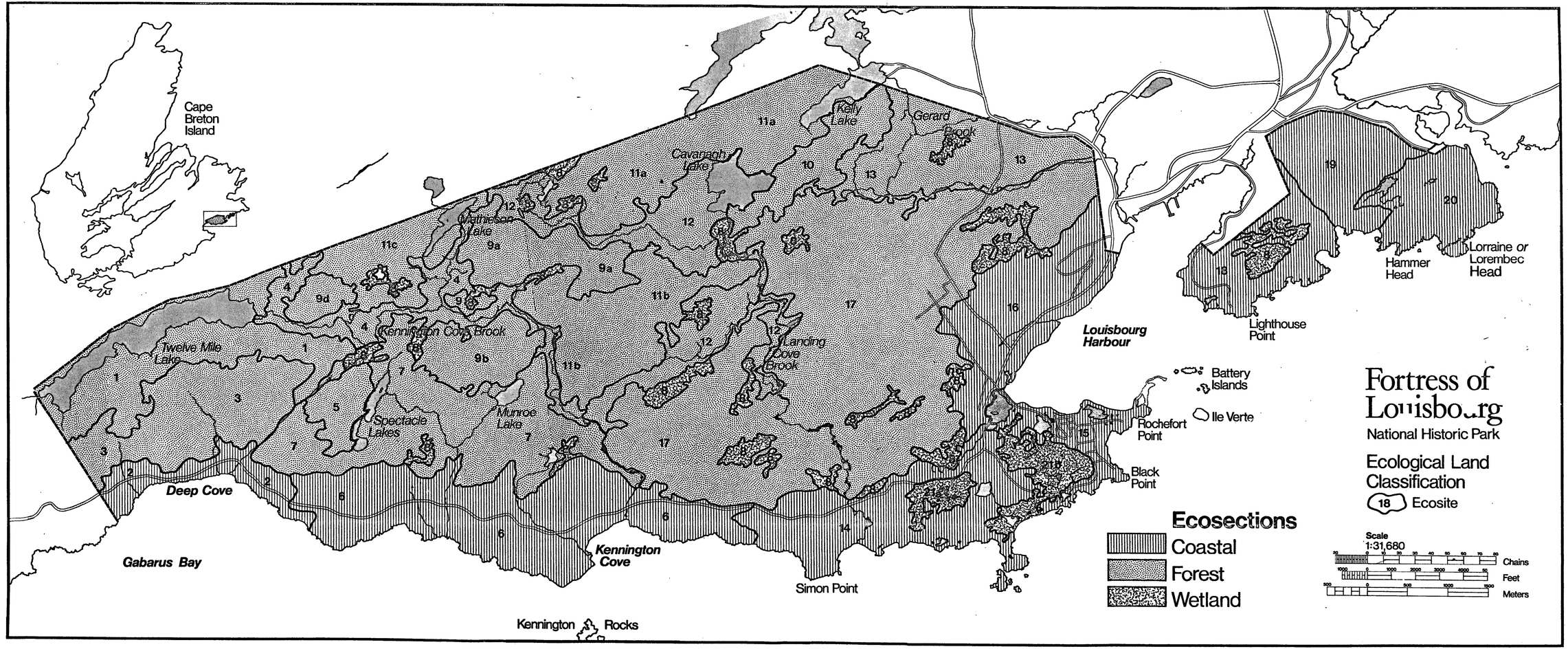
The National Historic Park comprises 21 distinct ecological units or ecosites as compiled from biophysical data gathered within the Park. Depending on the scale of the survey, this synthesis involves the classification of land into ecological units for interpretive purposes. Data gathering in an Ecological Land Survey (ELS) is an integrated procedure. Instead of stressing an isolated component of the system, it focuses on several components, especially the basic framework and relationships which sustain natural or man-modified ecosystems. The most immediate purpose of data gathering is then to delineate and describe areas of land which have ecologically significant and recognizable similarities. The characteristics generally used to determine similarity are the more stable and collective characteristics displayed via soils, geomorphology, climate, vegetation, hydrology and fauna. This procedure standardizes the characterization of land ecosystems and provides functional units which can be evaluated in ecological terms for various land uses.

The ELS is hierarchal in nature so that information can be assembled at various levels of detail, according to the needs of the user. Table I provides a general outline of levels of ecological generalization as proposed by the Canada Committee on Ecological Land Classification. The names for the levels of generalization vary in literature; however, the terms outlined in the Table are becoming more widely recognized.

Specifically, for the Park lands, the 21 "ecosites" can be grouped into three "ecosections" that all fall within one "ecodistrict" and "ecoregion".

3.1 Ecoregion and Ecodistrict

As the delineation of Nova Scotia into ecoregions and ecodistricts is currently underway, no official ecological land


Cape Breton Island
Twelve Mile Lake
Deep Cove
Gabarus Bay
Spectacle Lakes
Munroe Lake
Kennington Cove Brook
Kennington Cove
Simon Point
Kennington Rocks
Cavanagh Lake
Kelly Lake
Gerard Brook
Landing Cove Brook
Louisbourg Harbour
Battery Islands
Ile Verte
Rochefort Point
Black Point
Lighthouse Point
Hammer Head
Lorraine or Lorembec Head
Fortress of Louisbourg
National Historic Park
Ecological Land Classification
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Forest
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classification for the province exists to date. However, the final ecoregion and ecodistrict delineation for Nova Scotia are expected to follow, with modifications, the general boundaries as outlined by Loucks in his Forest Classification for the Maritimes. Thus, for the purposes of this survey the National Historic Park is deemed to fall within the Eastern Shore Ecodistrict of the Atlantic Shore Ecoregion as outlined by Loucks (1962).

3.2 The Park Ecosections

Three ecosections comprise the Park: coastal, forest, and wetland. Of these three, the wetland ecosection is composed of only two ecosites, the Louisbourg and Fortress Bogs. The eight coastal ecosites make up the coastal ecosection with the rest of the Park falling within the forest ecosection. It is through the synthesis and analysis of these ecosections that the ecology of the Park including plant succession and the effects of cultural activities will be described.

3.2.1 Coastal Ecosection

The shoreline of Louisbourg National Historic Park has a total length of approximately 31 km. In large part, it may be categorized as a high energy coastline that has an abrupt land/water interface whereby wave energy is dissipated in a violent manner as the waves come in contact with coastal cliffs. Except for Kennington Cove Beach, which has a sandy, gently sloping intertidal zone, the coastline consists of steep bedrock or till cliffs interspersed with a few, small, coarse, cobble beaches and berms. The declevity of the bedrock along the shore is such that in many places there is effectively no intertidal zone and water depths to several meters occur adjacent the land mass.

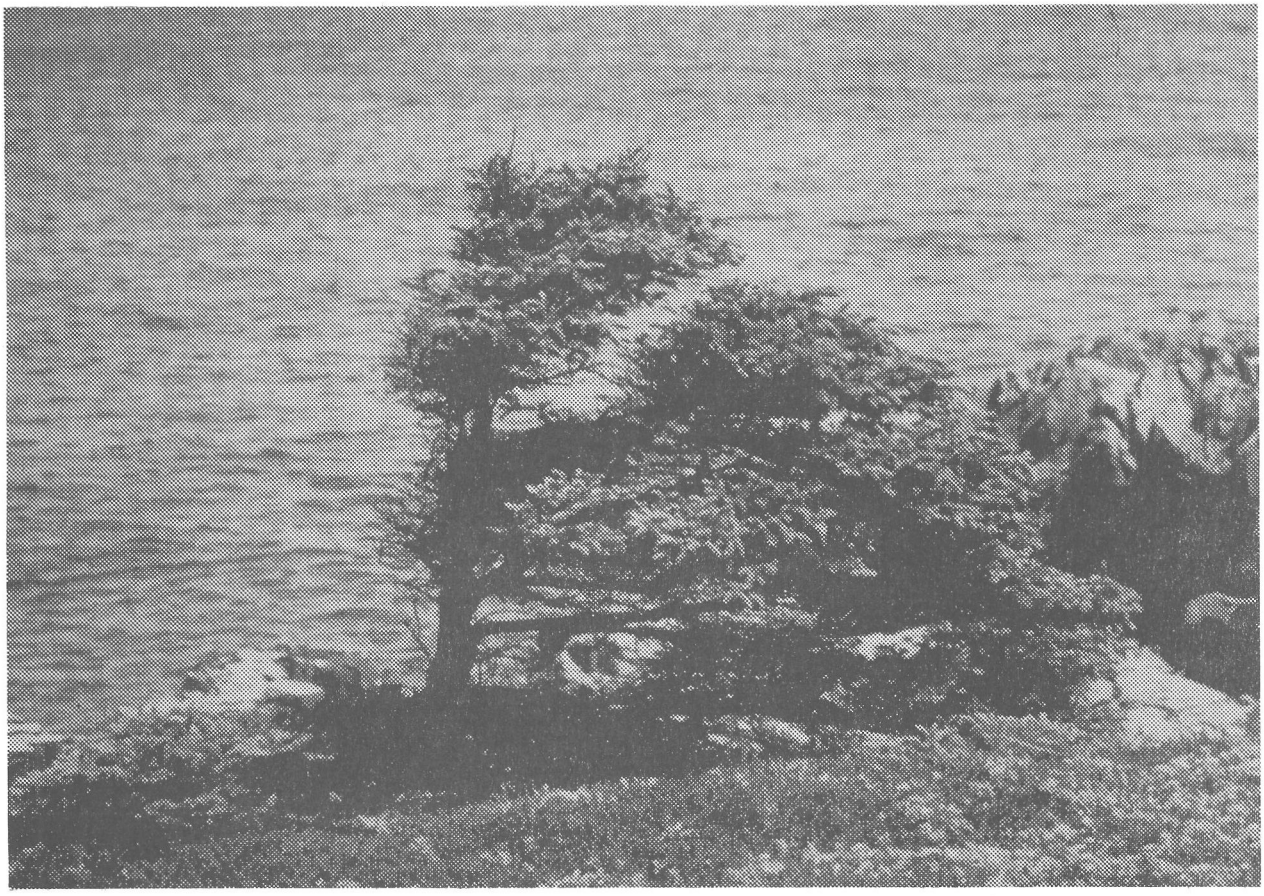

Figure 7 A contorted, wind-sculptured balsam fir along the Park's exposed coastline.

Over the past 5,000 years the Atlantic coastline has been sinking in relation to sea level. In quantitative terms, submergence is proceeding at a rate of 30 cm/century. Specific measurements at Louisbourg indicate that the datum (high tide level) has risen 80 cm in 250 years (Grant, 1975). Several phenomena are the source of this submergence. These phenomena touch on the effect of the added water available from melted glaciers and the continuous slow sinking of the continental margin during the last 140 million years. Perhaps the most significant contribution to the sinking coastline is related to ice pressure during glacial times which is currently causing the earth's crust off the Atlantic coast to collapse, thus allowing marine water to encroach on dry land. Suffice to say that submergence is due, in part, to a post-glacial sinking of the earth's crust and to an elevation of sea level by increase of tidal height.

The prevailing winds are from the southwest. Thus, except for sheltered Louisbourg Harbour, this coastline is rarely calm. The many small, cobble beaches and berms attest to a constant removal of fines from the beaches. The coastal till cliffs are compact and cohesive enough to minimize natural slumping. However, during storm surges, these cliffs are prone to wave erosion, as is the case at Kennington Cove. In contrast, at Rochefort Point, the base of the tills is subject to regular tidal erosion. This erosion is aggravated by the loss of cohesiveness of the till because of past cultural disturbances. The apparent exhumation of coastal grave sites by natural processes at Rochefort Point attests to the erosive force subjected on this site.

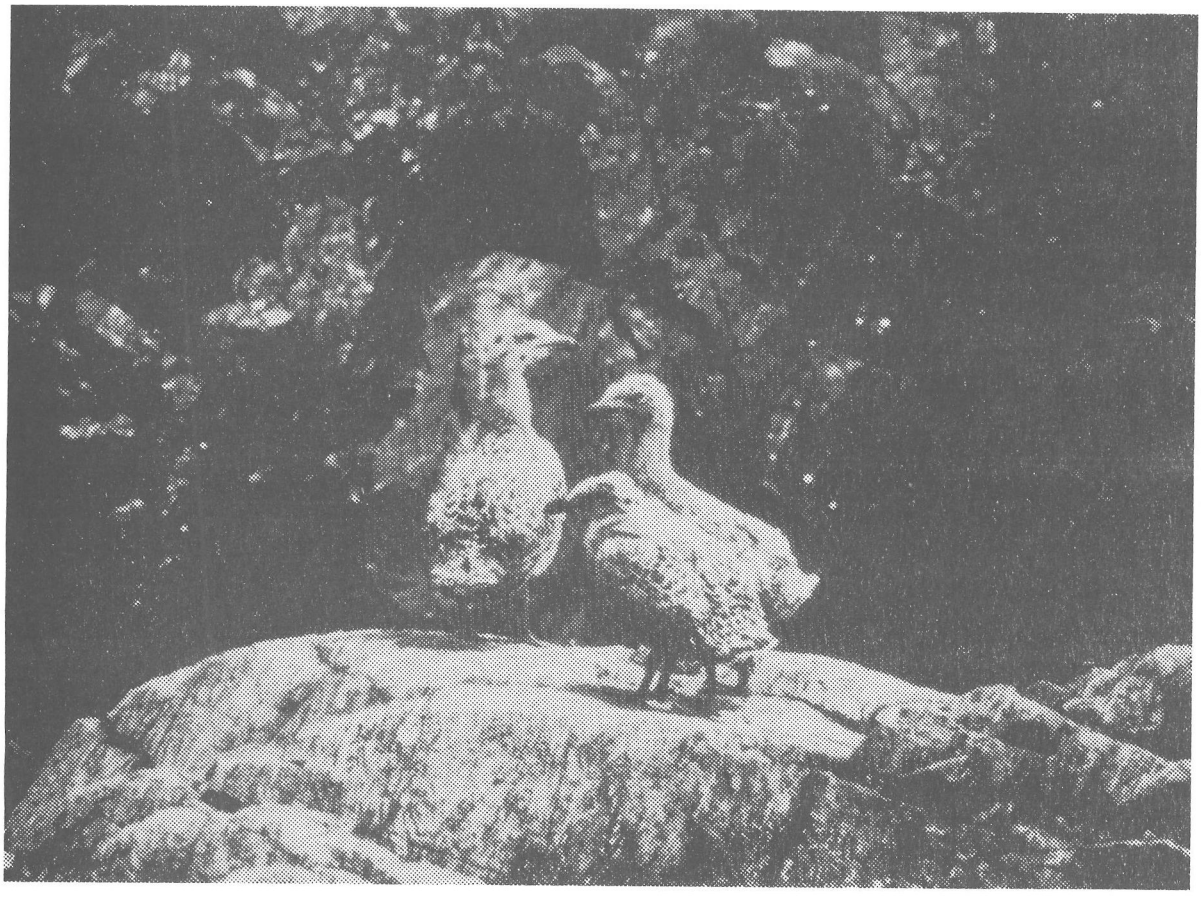

Figure 8 New born, flightless sea gulls camouflage well with the coastal bedrock where the nests are located.

Between Kennington Cove and the Fortress site, there are a number of coastal ponds bounded on their seaward sides by high cobble berms. The deposition of the cobble barriers is probably a relatively recent phenomenon which did not directly cause pond formation. Although driftwood clearly has been thrown over the berms by the sea during storms, the water is fresh or only slightly brackish. Some of these ponds have readily apparent upland drainage sources whereas, others are simple catchment basins deriving water from rainfall.

In contrast, the lagoons directly adjacent the historic site and at the end of Louisbourg Harbour have been landlocked artificially. During the 1700's, the French reinforced the natural harbour by building a seawall effectively closing the lagoons from the sea. These lagoons may yield useful data on the reconstruction of the local natural history. Any changes in salinity levels, major climatic fluctuations and other natural occurrences may be determined from natural indicators such as microfossils (e.g. diatoms, pollen and foraminifera) and datable carbonaceous deposits. As well, as these lagoons lay adjacent one of the largest population centres on the Atlantic seaboard in the 1700's, the sediments may hide a variety of 17th century paraphernalia in a relatively preserved state. Thus, a possibility exists for detailed analysis of these lagoons for analysis of both the natural and cultural history of the Louisbourg area.

A combination of natural elements such as exposure, salt spray and past cultural activities differentiate the coastal ecosection from the

inland forest ecosection. The reliance of early settlers on the marine waters for transportation and food naturally lead to a proliferation of cultural activity along accessible parts of the coastline. The clearing of the prevailing forest cover, the tilling of existing soils and the introduction of exotic plants by these settlers have all, to a degree, influenced the present day nature of the Park's coastal zone.

Minimal human disturbance of the natural ecosystem has occurred along the most exposed segments of the coastline. The cold prevailing winds coupled with shallow, nutrient-deficient soils discouraged such human encroachment. Thus, the coastline from Lighthouse Point to Lorraine, for example, is much the same as it was 300 years ago. Whereas, sheltered expanses of coastline as found at Deep Cove, Kennington Cove, Louisbourg Harbour and Big Lorraine have evolved through a series of cultural modifications. Thus, the coastal zone may be divided into three segments for analytical and descriptive purposes: the relatively undisturbed coastal heathlands, the coastal forest lands and the disturbed old fields.

3.2.1.1 Heathlands

The diversity of plant life within these coastal "barrens" lies in the several species of lichens and mosses that cling to the bedrock or largely shallow till soils. Tree cover is minimal and is restricted to poorly growing, contorted balsam fir. Exposed bedrock, shattered in places because

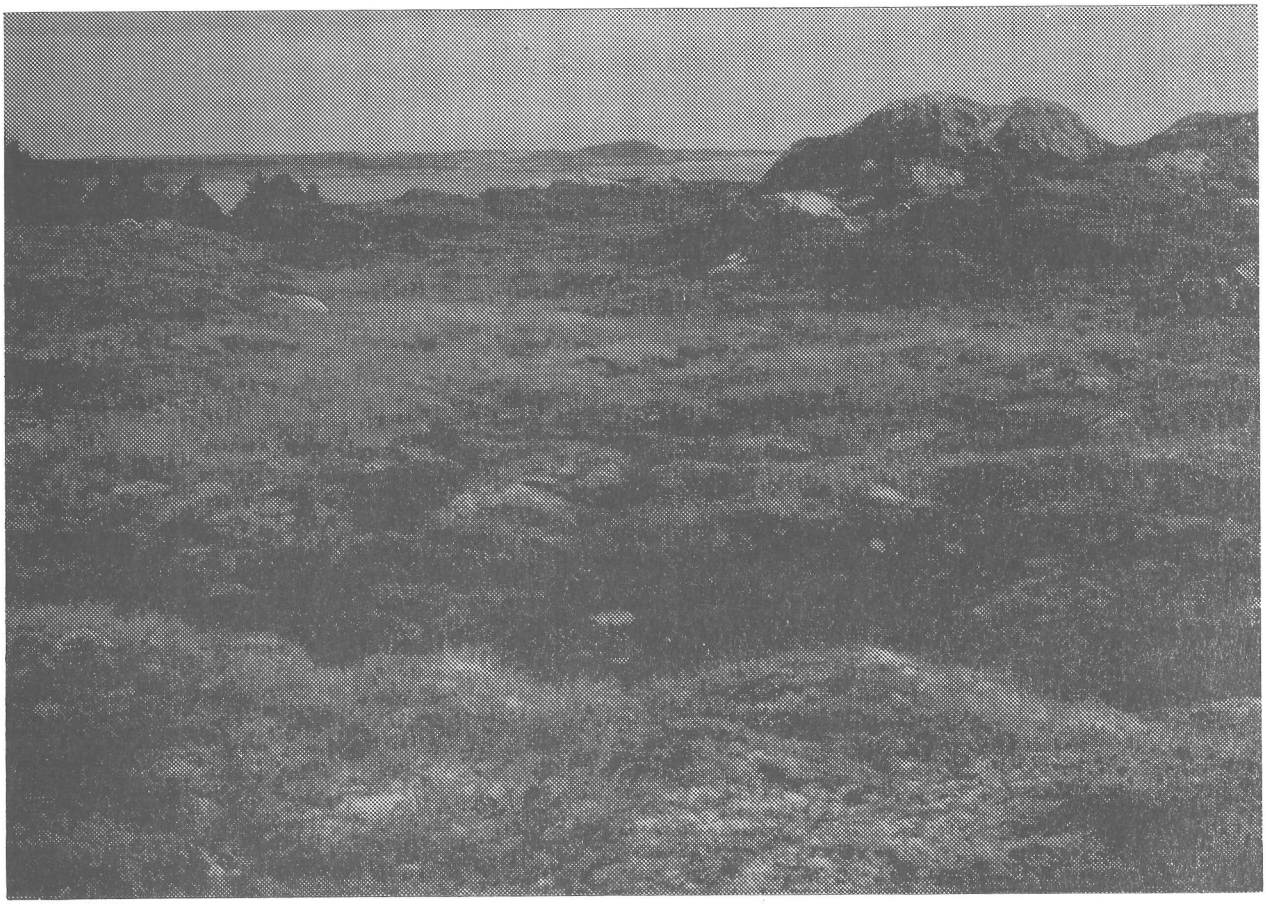

Figure 9 The heathlands along the coast are interspersed by rock outcrops and small shallow bogs.

of the alternate freezing and thawing of rainwater trapped within cracks, is the norm. Shallow till deposits are found capping the bedrock. Bogs with organic buildup rarely exceeding 1.5 m in depth have developed in catchment basins throughout these barrens. In locally moist positions, humic podzols have developed. Characteristically, organic matter, leached from the decomposing heath, has accumulated in the lower layers of the soil profile. The better drained sites, with a correspondingly less accumulation of organic matter, fall within the ferro-humic podzols. The degree of decomposition of the peat within the bogs covers the full spectrum from fully identifiable moss and sedge remnants to totally decomposed peat.

The mineral soils may have one or more very thin cemented layers occurring in the B horizons. These "placic" horizons are generally black to dark, reddish-brown, hard, wavy layers which are cemented by iron, iron and manganese or iron-organic matter complexes. Locally, the impermeable, placic layers may cause poor soil drainage conditions and subsequent peat development with poor tree growth.

These soils are indicative of generally cold and humid climate conditions. Vascular plants adapted to a procumbent posture and cushion growth form have a competitive advantage over taller, ericaceous shrubs with more rigid stems. As a result, plant species with a more northern distribution such as crowberry

and cowberry are cominant. The small, evergreen crowberry with its tiny needlelike leaves is omnipresent and can endure both the harsh cold winds and constant salt spray. Common associates include the small cranberry and the ground clinging common juniper. Taller, tolerant shrubs include clumps of sweet gale, bayberry and meadowsweet. Other shrubs such as sheep laurel, Labrador tea and blueberry are less abundant and characterized by a stunted growth form.

Tree growth is very poor and stunted. Exposure and poor soil conditions have limited coastal balsam fir growth to heights rarely exceeding 2 m. The stands approach 100 years in age and are dense. Tree development has been highly contorted by the prevailing winds. Once fire ravages these stands, re-establishment is very difficult. Remnant, bleached, balsam fir trunks are all that remain amongst scattered regeneration of a past fire near Hammer Head. Black spruce and larch occur in sheltered depressions with wet soils and display very poor growth and form.

Several species of lichens and mosses occur within the heathlands. No attempt has been made to identify individual species. However, the most common mosses encountered include Sphagnum fuscum and Sphagnum rubellum. Cladonia rangiforina and Cladonia alpestris are the most profuse lichens.

3.2.1.2 The Forest Lands

In contrast to the harsh environment of the

coastal heathlands, the coastal forest lands are sheltered (the coves more so than the intervening coastline) from the full brunt of the offshore winds. It was these lands that the French settlers, their decendants and other immigrants that followed, chose to settle and farm in the Louisbourg area. As with the heathlands, the unconsolidated subsurface material consists of a compact, sandy loam till. Bedrock outcrops, however, are fewer and the till mantle is generally deeper than that found within the heathlands. The soils are well-to-moderately-well drained. Ferro-humic podzols dominate and humic podzol development is negligible. Local areas of poor drainage have gleysol soils. Seepage, originating from the adjacent upland slopes, is common through the till.

Reflecting the better-drained soil and micro-climatic conditions, the crowberry heathlands have given way to balsam fir tree growth. Small, wind-contorted fir are found throughout the coastline. However, some of the stands south of the Kennington Cove access road (roughly the interior limit of the coastal ecosystem) have respectable tree growth with heights of 15 m not uncommon although, most stands average 9 m.

Most stand ages approximate 60 years. Balsam fir is the prevalent species with white birch and red maple occurring sporadically. Black spruce, a common tree throughout the Historic Park, occurs minimally within the

the coastal ecosection because it cannot tolerate heavy salt spray. In contrast, white spruce, because of its high tolerance to salt spray, is conspicuous. In places, pure white spruce groves can be found, usually adjacent old fields. A natural encroachment of white spruce into these fields is taking place.

Most of the Historic Park has been logged at one time or another in the past. The coastal forests are no exception. Remnant stumps can be found throughout the current stands. Many of the present stands have suffered from windthrow and others have been opened for a variety of purposes by man. Consequently, where the sunlight reaches the forest floor, a myriad of plants and shrubs can be found. Essentially, balsam fir is regenerating itself and outcompeting the maple and birch seedlings for growing space.

Under a closed canopy the ground flora are minimal. Ground cover is generally limited to a carpet of feather mosses dominated by Pleurozium schreberi. Balsam fir is a relatively short-lived species, rarely approaching 100 years in age, and is susceptible to numerous diseases. Thus, it is prone to windfall. Once the stand is opened pioneering plants become conspicuous. Ferns such as bracken and wood fern proliferate. Cinnamon fern occupies local depressions. In small openings and sun patches, common flora include bunchberry, starflower, wood sorrel, gold-thread and lily-of-the-valley.

These species and many more are common in woodland openings throughout the Historic Park. Basically, the lack of a black spruce presence, the prominence of white spruce and growth rates still slowed by exposure distinguish the coastal ecosection from the inland forest section. Past cultural activities have contributed to a more diverse stand age and structure than is found inland. However, except within the old fields, these activities have not lead to a wider diversity of vegetative species or to a substantial alteration of the terrain.

3.2.1.3 Old Fields

The concentration of old fields is centered on Deep Cove, Kennington Cove, Louisbourg Harbour and Big Lorraine. Rock pile fence lines now overgrown by shrubs and trees identify many of these former farmlands. Because of the stony nature and inherent poor fertility of the soils, these farmlands were marginal producers at best. Yet, even within the present Park boundaries, the current vegetative communities provide us with an indication of relative capability of these lands when compared with each other. On this basis three categories of old field are discernible.

The first category can be termed Angelica Old Fields. These old fields represent the best of the poor land available for homesteading. These fields occupy the best sheltered lands along the Louisbourg coastline. This

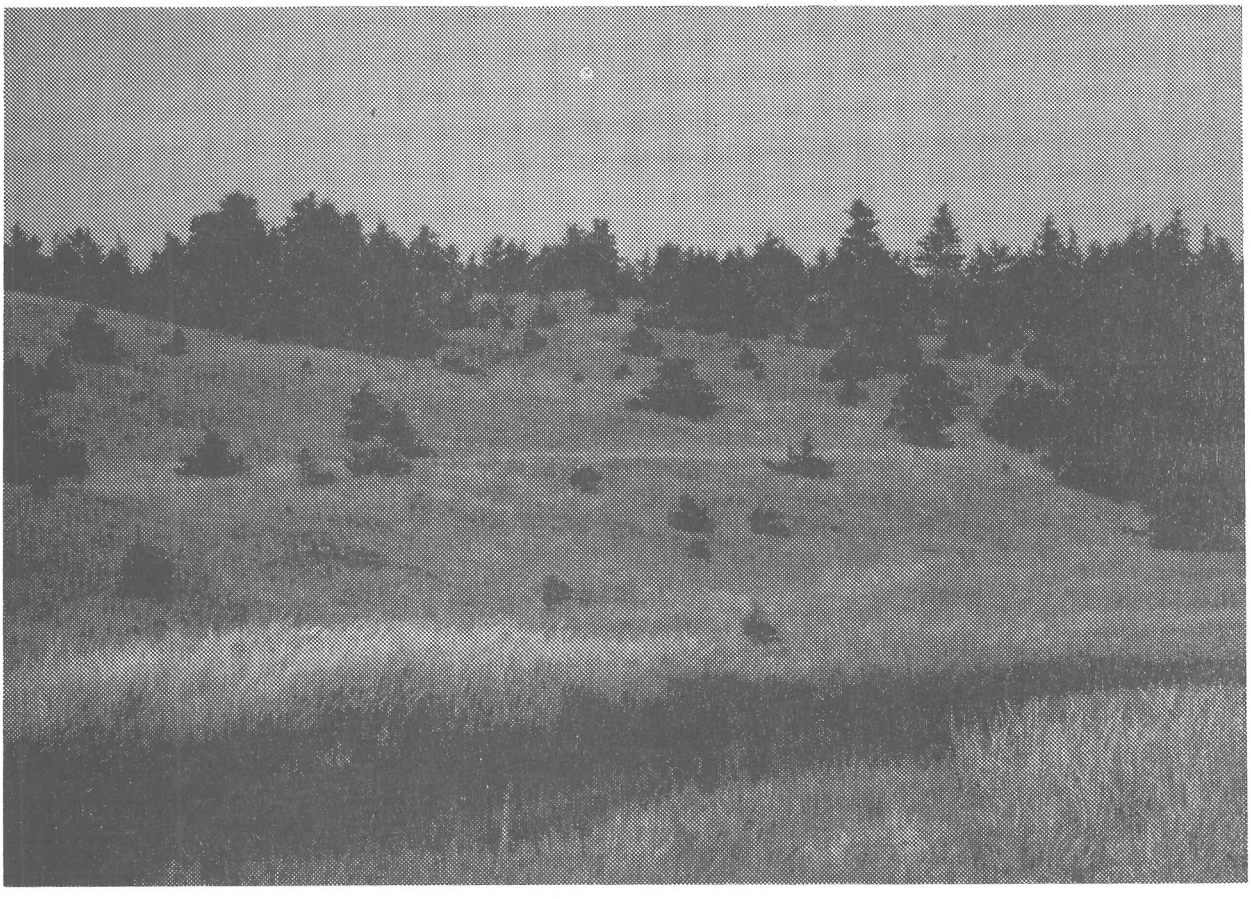

Figure 10 White spruce encroachment on old fields.

includes the inner reaches of Louisbourg Harbour and Lorraine Bay. The underlying tills are deep and generally well-drained and the slope to sea level is gradual.

The introduced Angelica is rampant. It is a plant that cannot endure exposed sites. Thus, it grows wild in these sheltered fields and along the Park roads, but it is not abundant in the coastal fields west of the Fortress. Other signs of relative fertility include the diversity and taller growth of the vegetation within these fields than if found elsewhere. Common shrubs include rhododendron (a shrub also characteristic of sheltered sites), alder, sweet gale, Labrador tea and wild raspberry. The field weeds are many with the following groups being most common: asters, goldenrods, hawkweeds, and knotweeds.

Scattered white spruce encroachment is taking place. Along the field edges balsam fir regeneration is thick. Other tree species present, but with growth not much beyond that of a healthy shrub, are cherry and mountain ash.

The second category of old fields may be called Cinquefoil Old Fields. This category represents the more exposed well-drained fields at Deep Cove and spotted along the coastline east of Deep Cove. As with the Angelica Old Fields, the soils are generally nutrient deficient and podzolic development is prominent. The till is stony and seepage is

common. Exposure limits the profusity of species. Threetooth cinquefoil is the indicator species for the category, although it is not as conspicuous as Angelica is for the Angelica Old Fields. It is a transitional species identifying coastal climates between sheltered land and fully exposed land. Other representative species include wild strawberry and wild rose. Naturally, the asters, hawkweeds and grasses and other prolific field weeds are present.

Also found within these fields are large tussocks of the introduced moorgrass. This is an extremely tough and persistent plant with fibrous roots. An introduced weed, Devils'bit is also evident, particularly when the light blue flowers have appeared.

The third category of old fields identified as Crowberry Old Fields covers those cleared areas with poorly drained soils and not sheltered from the prevailing winds. These clearings are adjacent the coastal barrens and some are reverting to a continuous cover of crowberry. Analysis of the soils of these fields reveals that the "Ae" layer or leached layer is not as pronounced in the podzolic profile as it is for the undisturbed heathlands and the organic capping is generally thinner in the disturbed soils. However seepage is rampant and gleying is evident throughout the soil profile.

Representative plants include those which are common on moist, exposed slopes

throughout the Park. Along with crowberry, there are bake-apple, bog rosemary and sphagnum mosses. An introduced species, tiny all-seed, grows to heights of 3 cm and as thick as grass over some of the wet pasture slopes close to the sea.

3.1.2.4 A Park Perspective

The coastal ecosection is probably the most interesting ecosection within the Park because of the diversity of attractions it has to offer. Certainly, it is the most aesthetic ecosection of the Park. Natural features, such as the block faulting of the coastal bedrock so evident from Deep Cove to Kennington Cove and east of Lighthouse Point, are an educational, as well as an aesthetic, attraction. The crowberry heathlands are a veritable outdoor classroom. The effects of exposure are immediately noticed by the form and shape of the coastal balsam fir. Visual analysis of shrubs such as crowberry and juniper reveal why these plants thrive in the barrens and others do not. In the fall, the presence of the myriad of mosses comes to light when the ground cover assumes various shades of the colour spectrum.

Interpretive trails could traverse both the coastal forest land and the heathlands (the existing trail from Lighthouse Point to Lorraine is ideal) allowing visitors to mentally note the changes in vegetation communities as the micro-climate changes.

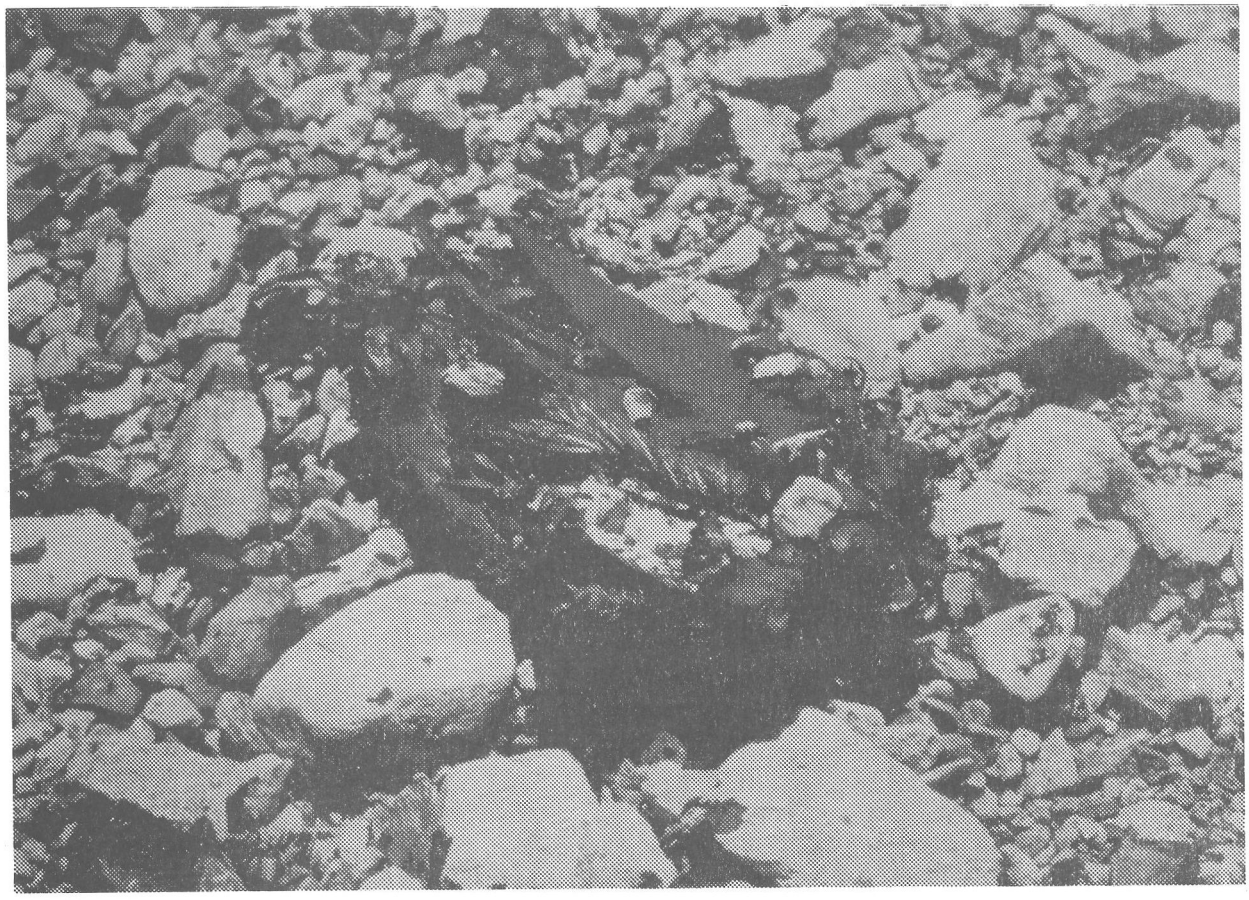

Figure 11 A dead seabird, a casualty of the Kurdistan oil spill, found along the Park's coastline.

Along the coastline, the lingering effects of hydrocarbon contamination may be viewed. Many of the cobble berms are still impregnated with oil from the ill-fated tanker "Kurdistan". The trails could point out the relentless power of the sea as evidenced from the many lobster traps strewn along the beaches. Also, driftwood could be found within low lying coastal forest stands.

From a preservationist point of view, Rochefort Point deserves attention. The unconsolidated drift is being rapidly eroded by constant wave action. Without remedial action, the historic graveyard and perhaps other, yet to be unearthed, archaeological findings are in danger of being swept away by the sea. Sea gull nesting sites, although scattered, may be found on the rugged, rock cliffs, particularly between Deep Cove and Kennington Cove. These nests and the newly-born gulls, when flightless in early July, are susceptible to human harrassment. If visitor traffic increases, some public awareness program would be needed to reduce this threat of harassment.

The old fields provide Parks resource personnel with an ideal outdoor classroom by which the many interrelationships of the natural ecosystem could be explained to an interested public and in certain instances relate these interrelationships to past cultural activity. For example, the remnant stone fences attest to the inherent stoniness of the soil and provide an indication of the

difficulty previous owners had in tilling the soil. Introduced plant species from French settlement days, such as Angelica, could be pointed out and tied to the historical past of the Park. In addition, Angelica is a good indicator of exposure conditions. Its relative abundance in certain fields gives indication that that field is sheltered from coastal winds. Exposed fields are scarce with Angelica.

A close analysis of the distribution of white spruce along the coast reveals that it is concentrated along the margins of the abandoned fields. The species is slowly encroaching onto the fields themselves. Eventually, if left undisturbed, the spruce would overgrow these fields. This encroachment is clearly visible and may be utilized to discuss vegetative succession.

3.2.2 Forest Ecosection

This ecosection, consisting of 11 ecosites, comprises the interior forest lands of the Park. The terrain is generally hummocky to gently rolling with a continuous forest cover dominated by balsam fir. Depending on site conditions, stands may contain only fir or fir in various combinations with other conifers and hardwoods. Commonly associated conifers include eastern larch, black spruce and white spruce. Prevalent hardwoods include red maple, white birch, speckled alder, sugar maple and yellow birch.

Palynoligical records indicate that the stand composition has essentially stayed the same over the past three hundred years. In the early 1700's the forest cover was characterized by abundant balsam fir with birch, spruce, alder and eastern hemlock as

important components. White pine and various hardwoods were present, but to a limited extent. Only eastern hemlock appears to have depleted over the years to the extent that the current ecological survey of the Park did not record any hemlock as being present. There is no evidence to indicate that natural climate or site conditions have altered such that hemlock cannot survive. More probably hemlock was a preferred species of the colonists and over the years, it was selectively cut to the point of depletion.

The entire Park lands have been repeatedly logged over the years. Current forest cover is directly related to this past logging. Balsam fir, the prevalent species throughout the Park, has the ability to regenerate under its own stand cover as well as being a prolific pioneering species in recently disturbed areas. Fir stands and fir-spruce stands normally reproduce readily and have remarkable recuperative capacity. Advance fir-spruce reproduction under many older stands usually assured new fir-spruce stands after the overstory was harvested. This has resulted in balsam fir stands that currently encompass a number of age classes.

The major pest of the first stands of Cape Breton is the spruce budworm. Dead and dying fir are rampant in the stands within the Park, especially north of the Old French Road. Thus, windthrow is widespread in these sites. As well, fir and spruce both are relatively shallow-rooted and susceptible to windthrow except in the most sheltered areas. For this reason, windthrow is widespread inland of Hammer and Lorraine Heads.

Once closed stands are disturbed naturally, or by man, pioneering hardwood species may assume prominence.

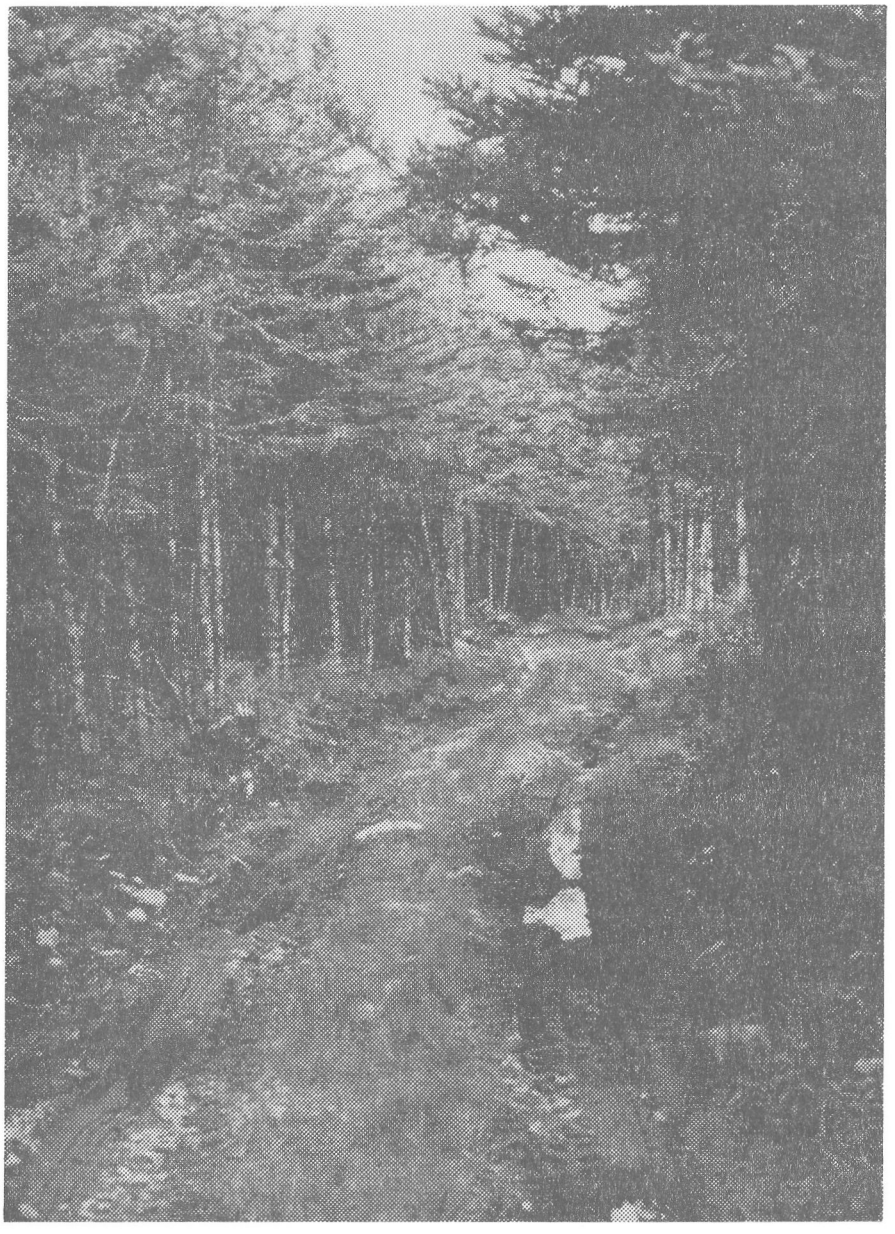

Figure 12 The Old French Road, used as access to the northern portion of the Park, passes through thick stands of balsam fir. Throughout the Park a goodly portion of these fir are affected by spruce budworm.

White birch and red maple rapidly spread into disturbed openings in upland well-drained sites. Alder does the same for poorer-drained soils. Once these hardwood stands are established, they cannot readily maintain themselves because the seedlings cannot survive heavy shade. Hence, oftentimes, balsam is the dominant understory within these stands and eventually forms the major component of the stand as the hardwoods die.

Within the Park, the largest concentration of birch and maple occurs within the ecosites bordering Twelve Mile Lake. These upland ecosites have well-drained soil conditions with the spruce and balsam generally being restricted to imperfectly drained slopes or poorly-drained depressional areas.

Because of its intolerance to heavy salt spray, black spruce is not prominent along the coast. Inland, it is present throughout the forest ecosection although it is concentrated on wet mineral soils and along the margins of bogs. Eastern larch (tamarack) is restricted to the wettest of sites adjacent bogs. Sugar maple and yellow birch occur sporadically throughout the well-drained upland soils.

In terms of plant associations, the forest ecosection, with its respective ecosites, covers the following plant communities:

3.2.2.1 Black Spruce/Sheep Laurel

Black spruce is the predominant tree cover with sheep laurel being the most prominent ground cover. This plant community has limited distribution within the Park occupying lowland areas bordering ponds, lakes and bogs. Common associates include Labrador tea, leather leaf

and spirea. Under the shrub cover, pitcher plant, sundew, cranberry and sedges are common plant species. Sphagnum forms a continuous ground cover.

3.2.2.2 Balsam Fir/Feather Moss

Much of the forest ecosection falls within this vegetation association. Balsam fir forms a uniform stand cover. Except for the feather mosses (dominated by Pleurozium schreberi), ground cover is minimal. The stand is prone to windthrow. Once disturbed, intolerant hardwoods may establish themselves. As these trees develop, the fir assumes prominence in the understory as the shade severely restricts competition from other species. Eventually, a fir-dominant stand is established.

3.2.2.3 Balsam Fir/Wood Fern

This association is common on moist upland sites within the Park where the balsam fir is mature and forms the stand composition with white birch. The stand is more open than the previous association, thus allowing the growth of a diversity of boreal herb species. Wood fern in abundance is a diagnostic feature of this association. Common plants include bunchberry, starflower, lily-of-the valley, clintonia and wood sorrel.

The stands with a major constituent of red maple and white birch along with a minor occurence of sugar maple and yellow birch may be classified with this association. As time progresses, these stands will eventually be domin-

ated by fir and through windthrow, disease or other disturbance the cycle repeats itself.

3.2.2.4 Balsam Fir/Bracken Fern

This association is relatively scarce within the Park. It predominates on the crest of hills and knolls where the drainage is well-drained and general soil conditions are dry. Windthrow is prevalent which, in turn, results in an open stand characterized by a diverse species list. Spruce and white birch are common associates of the fir. Ground cover consists of bracken fern with many upland boreal species. These include twin-flower, shinleaf pyrola, goldthread, mayflower, creeping snowberry, bunchberry and the feather mosses.

3.2.2.5 Alder/Meadow-Rue

This association follows the flood plain of the streams traversing the forest ecosection. Soils are imperfectly to poorly drained restricting tree growth to stunted spruce and larch. Alder in shrub form is abundant. High-bush cranberry, spiraea and sweet gale are also conspicuous. Under the alder, meadow-rue, blue flag, manna-grass and asters form a thick ground cover. Sensitive fern, royal fern and interrupted fern are also diagnostic species of this plant association.

3.2.2.6 A Parks Perspective

Spruce budworm is rampant through this ecosection as it is through much of Cape Breton.

A goodly portion of the dead fir throughout the Park have died because of budworm infestation. A walk along the Old French Road and towards the northern boundary of the Park provides a revealing glimpse of the extent of the damage to fir stands. An associated problem related to the budworm damage is the high fire hazard created by the dead and dying trees. During dry summers, these stands are a ready source of fuel for the slightest indiscretion with fire. To alleviate this threat, a thorough felling and cleaning of the dead snags is needed. As well, a more ready access route should be available to the northern and central portion of the Park.

As fir is a shallow-rooted tree, windthrow is a problem throughout this ecosection. This windthrow is accentuated when coupled with the fact that fir is not noted for vigorous growth beyond 60 years. Thus, if campsites or extensions to parking sites are planned, this potential for damage from toppled trees should be taken into account. Narrow fir strips should not be left as buffers as these isolated strips are much more prone to windfall than full stands. Areas of shallow soils should be avoided for similar reasons.

The enhancement of the hardwood component of this ecosection would add aesthetic appeal to the overall character of the Park. Selective cutting of certain fir stands, particularly those heavily infested with budworm would lead to a natural propogation of maple and birch with minimal post-cut silvicultural attention.

Earlier mention was made of plant succession when the encroachment of white spruce onto abandoned fields was discussed. The various disturbed states occurring within the forest ecosection of the Park provide an ideal background by which to illustrate the concept of plant succession. The simplest approach to an understanding of plant succession is to postulate an unvegetated substrate, and then to deduce the successive plant communities that will occupy this site under the assumptions that the regional climate will remain unchanged and that catastrophic disturbances such as windstorms, fire or epidemic will not occur.

Naturally, these assumptions are unrealistic. Their adoption, however, does provide for an understanding of the development of vegetation on any area as an orderly, successional sequence depending upon site conditions. There is no need to discuss in detail succession within the Park from the time of the retreat of the last glacier. In short, the fresh deposits of tills left behind by the glaciers were probably invaded by various lichens, mosses and annuals. Eventually, shrubs began to take root, followed by intolerant trees, and finally tolerant trees.

The relationship between intolerant and tolerant trees can be illustrated within the Park. Intolerant trees are those trees that cannot survive under shade. They are the species that are the first to invade a disturbed site. These species include white birch

for the uplands, eastern larch for the wet lowlands, and alder for moist to wet site conditions. Once these species become established, they cannot regenerate within the shade of the understory. Thus, depending on site conditions red maple, sugar maple, balsam or spruce, the tolerant tree species, form much of the regeneration. Once the birch and alders die, these species assume prominence and birch and alder cannot gain a foothold until a disturbance creates a stand opening.

Balsam fir is the most tolerant species found within the Park. It can endure heavy shade and for that reason, it is often found as the major regenerating species under a predominantly fir canopy. Not only are the fir stands self-sustaining but, once established in the understory of adjacent stands, it has a competitive advantage for survival over the other common species.

3.2.3 Wetland Ecosection

The wetland ecosection comprises the peatlands (ecosites 8 and 21) within the Historic Park. These peatlands vary in size and location, being scattered throughout the Park. The largest individual peatlands (ecosite 21) occur adjacent the restoration site of the Fortress of Louisbourg. The peatlands fall under the general category of "bogs". By definition, bogs are "peat-covered areas or peat-filled depressions with a high water table and a surface carpet of mosses, chiefly Sphagnum. The water table is at or near the surface in the spring, and slightly below during the

remainder of the year. The mosses often form raised hummocks, separated by low, wet interstices. The bog surface is often raised, or if flat or level with the surrounding wetlands, it is virtually isolated from mineral soil waters. Hence, the surface bog waters and peat are strongly acid and upper peat layers are extremely deficient in mineral nutrients." (Zoltai, 1977)

The bogs within the Park are generally slightly raised and gently sloping. The most pronounced bog development "raised" above the surrounding terrain is the large bog immediately adjacent the restoration site. Bog development is directly correlated with the character of the climate: the abundant precipitation, relatively low atmospheric humidity, cool summers and the absence of extreme winter temperatures. The origin of the existing bogs can be traced to poor drainage due to topographic confinement. These bogs were probably pre-existed by fens or marshes. The slow but progressive accumulation of sediments, organic detritus and plant material in these wetlands eventually removed the roots of the surface vegetation beyond what soil water influence was available. Many of the plants originally adapted to the sites soon gave way to the sphagnum, ericaceous shrubs and sedges. Under cold, climatic conditions accumulation of peat proceeded much faster than decomposition until eventually the surface of the deposit was sufficiently removed from the water table to become somewhat drier near the bog centre. Sphagnum overtook sedge as the primary peat producer at the bog centre and in the absence of competition grew rapidly and formed dense blankets of peat.

Bogs several metres thick do occur in the Maritimes; however, the bogs within the Park rarely exceed three metres in depth. The peat may directly overlie bedrock

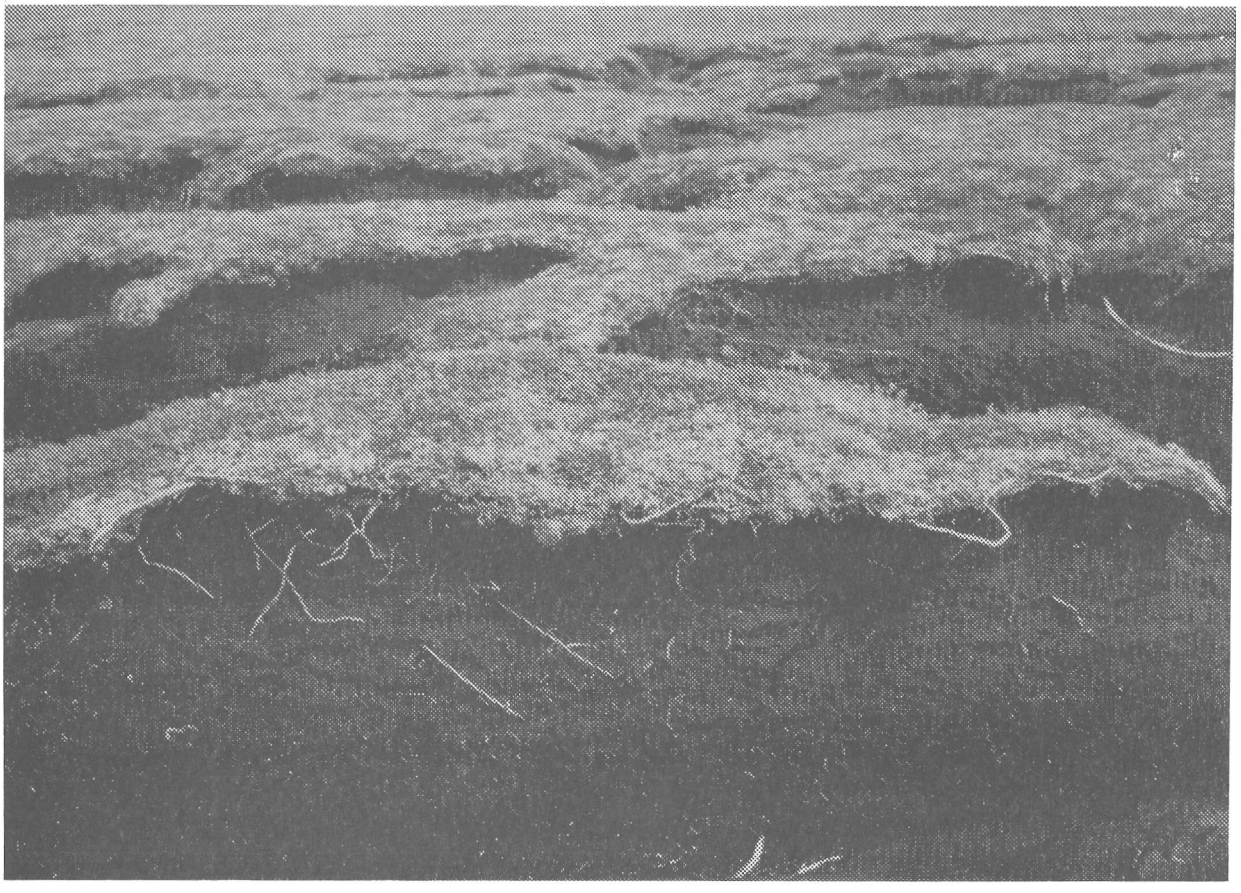

Figure 13 Foxholes within the dry layers of the peat of Louisbourg bog. The darker peat outlines the water table during the wet spring season.

or it may have a fill base. Detailed analysis of several of the bogs indicates that the upper tiers consist mainly of sphagnum peat with a degree of composition of H3 to H5 utilizing the von Post scale of decomposition where H1 indicates little to no decomposition of the plant material and H10 indicates total decomposition of the plant material such that the original plant material is indistinguishable. At depths greater than 200 cm sedge peat is common with H values approaching 10 below 250 cm.

The two sample bog depth profiles that follow are representative of bogs within the Park:

Railway Bog Inland of Lighthouse Point

Depth (cm)	Von Post Scale	Comments
0 - 55	4	sphagnum peat
55 - 75	4 - 5	sphagnum peat
75 - 93	5	sphagnum peat
93 - 150	7	small twigs sedge peat
150 - 200	9	
200 - 235	10	
235 - 250	10	twig remnants
250		bedrock

Kennington Cove Road Bog

Depth (cm)	Von Post Scale	Comments
0 - 65	5	sphagnum peat
65 - 70	4	crushed rock (old road remnant)
70 - 110	4	
110 - 175	3-4 (corduroy remnants)	sphagnum peat
175 - 200	5-6 (corduroy remnants)	sphagnum peat
200 - 260	7-8	sedge component
260 - 270	9-10	
270		

Vegetation consists mainly of sphagnum species and ericaceous shrubs. On the drier bog sites Sphagnum fuscum, imbricatum and flavicomans are abundant. Where the water table is at or close to the surface, papillisum, magellanicum and flavicomans are prominant. The wettest sites are indicated by the presence of tenellum and pulchrum. Aquatic sphagna, represented by majus and cuspidatum, are found within the open pools of the bogs.

Besides the sphagna, species such as sheep laurel, crowberry juniper and bake-apple occur throughout most of the sites and vary in abundance and cover with site conditions. Lichen and cowberry are good indications of dry, exposed sites. Associates with Sphagna on wet sites include bog cranberry, bog rosemary and sedges. Water lillies and buckbean are the most conspicuous bog pool plants.

Aesthetic plants of note include the pitcher plant and the less common orchids such as the lady's slipper, purple-fringed and white-fringed orchids. The sundew is a delicate, colourful insectivorous plant and except for its tiny size, would be readily pleasing to the eye.

3.2.4 A Park Perspective

The aesthetic value of the bog herbs and mosses is not the only attraction of the wetland ecosection. Bogs are characterized by a number of important species of small fruits. Partridge berry is abundant on the coastal bogs where it competes for space with crowberry. Two bog cranberries (Vaccinium oxycocus and macrocarpon) are also common on the wetlands. Blueberry and bake-apple are present; however, often the fruit yield is minimal because of a combination of competition from other plants and local microclimatic conditions not conducive to prolific fruit production.

The coastal wetlands may hide some historical artifacts dating to the 18th century occupation of the Fortress by the French and English. During normal depth probe procedures on the Kennington Cove Road bog, the remnants of an old French or English roadbed were encountered. These bogs were a means of easy access during winter through the rough terrain of the Louisbourg area. Other remnants of 18th century colonization may lay buried within the peat layers.

In a more general sense, acid peat bogs preserve plant remains in great abundance. Through studies of these fragmentary remains it is possible to isolate fossil wood in the various levels of peat and date them by carbon-14 dating. Such analysis would provide insight into past climatic fluctuations. Plant pollen is also well preserved within bogs and techniques in pollen analysis can be used to document changes in vegetation over the life of the bog. These changes, if any, may then be analysed in terms of cultural or natural disturbances.

Specific bog plants may be pointed out to the public because of inherent species characteristics. The pitcher plant drowns its insect prey in water gathered at the base of the plant. The sundew, another insectivorous plant, consists of sticky hairs that attract and hold small insects as they land.

Fortress Bog (Ecosite 21) is a good example of a raised bog. The eroded ponding channels within the bog reveal the height of the peat layer that has accumulated over and above the water table. In places, the growth of the sphagna and ericaceous shrubs has produced peat accumulations of close to 2 m above the summer high water table levels. The dryness of these upper peat layers is

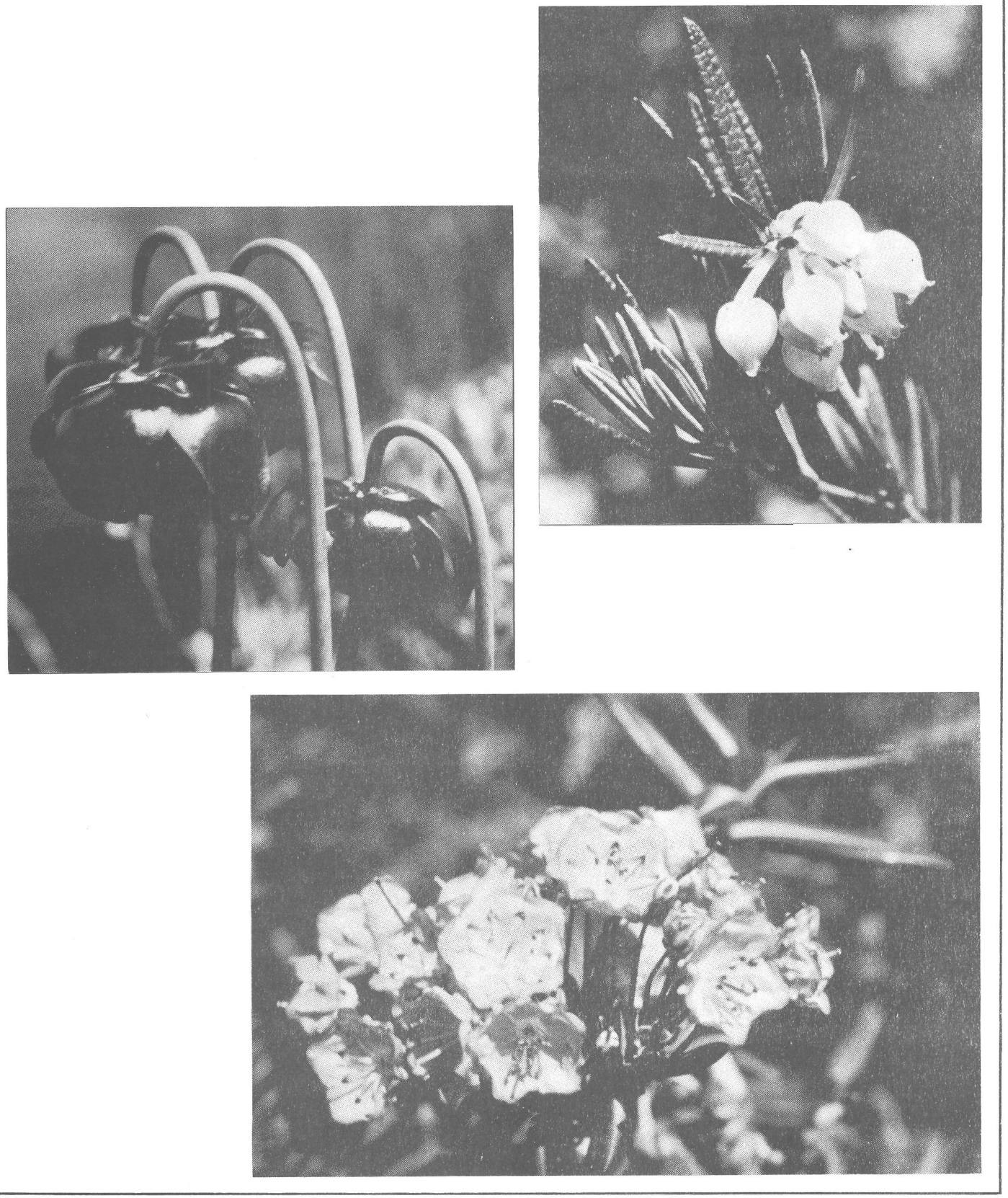

Figure 14 Many bog plants are pleasing to the eye. These plants include bog rosemary (top), pitcherplant (middle), and sheep laurel (bottom).

accentuated by the presence of scattered fox holes throughout the bog.

3.3 Ecosites

The Historic Park consists of 21 ecosites. Each ecosite is characterized by a relatively uniform parent material soil, hydrology and a chronosequence of vegetation. They formed the basic mapping unit of the ecological survey of the Park and they can serve as the basic management unit for Park planning purposes. The Louisbourg Bog ecosite (ecosite 8) includes all of the larger inland bogs that occur within the Park. If it is deemed necessary to identify the individual bogs for management purposes, an added designation for each bog is needed.

In this section each ecosite is described briefly as to its location, areal extent and physiographic and vegetative characteristics. In addition each ecosite is categorized in the environmental Data Bank for the Park.

3.3.1 Ecosite 1 (Twelve Mile Lake Hill) (areal extent - 328 ha)

General Description - The lands adjacent the south shore of Twelve Mile Lake comprise this ecosite. Elevations rise from 84 m a.s.l. (the elevation of Twelve Mile Lake) to approximately 105 m a.s.l.

Physiography - A pattern of broad knolls and ridges separated by poorly drained depressions depict these uplands. Bedrock outcrops are common and a shallow till layer over bedrock is prevalent except in the vales where organic buildup has occurred over either till or bedrock. Soils are generally well-drained on the slopes and hilltops with ferro-humic podzols dominating. Gleysols and organic soils are prevalent in the depressions. Bogs are scattered and generally small in areal extent.

Vegetation - Balsam fir in association with red maple and white birch, form the predominant tree cover. Sugar

maple and yellow birch are also more abundant within this ecosite than the other ecosites outlined for the Park. Black spruce is prevalent in the poorly-drained depressional areas amongst the knolls and ridges. Blowdown has occurred on some of the ridges.

Bracken fern, New York fern, wood fern occur in openings within the hardwood stands. White birch and maple regeneration is widespread. On the swales, Labrador tea, sheel laurel and leather leaf are common associates with black spruce.

Water Bodies - No permanent water bodies occur.

3.3.2 Ecosite 2 (Oceanview) (areal extent - 97 ha)

General Description - This ecosite encompasses the coastal lands surrounding Deep Cove at the western extremity of the Park. Elevations rise from sea level to 45 m a.s.l.

Physiography - Rugged, steep, coastal rock cliffs characterize the shoreline. Where the bedrock does not abut the coast, cobble beaches occur at the base of steep till cliffs. Beyond these cliffs, the terrain is level to slightly sloping to the access road. This access road parallels the base of a steep-faced slope which forms the inland extent of this unit. Much of the abandoned farm fields overlie a deep, strong compact till. Elsewhere, shallow soils predominate and exposed bedrock is common. Seepage occurs at the interface of the till and underlying bedrock. Soils are well-drained to moderately, well-drained ferro-humic podzols.

Vegetation - The abandoned coastal farmlands consist of scattered white spruce and white spruce

groves. A myriad of field plants occur including raspberry, honeysuckle, goldenrods, asters and buttercups. Wild rose bushes are also conspicuous. The uncleared, steeply sloped land consists largely of balsam fir stands which have been subjected to blowdown.

Water Bodies - Except for a few small streams draining the adjacent uplands, no water bodies occur.

3.3.3 Ecosite 3 (Deep Cove Plateau) (areal extent - 253 ha)

General Description - This ecosite occupies the upland area between Deep Cove and Twelve Mile Lake. Elevations vary between 45 m and 114 m a.s.l.

Physiography - A series of ridges roughly aligned in a northwest-southwest direction with intervening depressions form much of the topography of this ecosite. A compact, gravelly, sandy loam till, common throughout the Park, forms the overburden. Rock outcrops occur sporadically. The poor drainage, associated with the depressions, has led to the development of many small bogs. The ridge slopes are generally moderately, well-drained. Ferro-humic podzols with gleyed sub-groups are the most common soils. Gleysolic development has occurred in the poorly drained swales. Bog depths do not exceed three metres over bedrock. Mesisols are prevalent within these peatlands.

Vegetation - The moderately well-drained to well-drained ridges and knolls are characterized by balsam fir in association with red maple and white birch. Depressional areas have black spruce as the dominant species. Larch occurs sporadically in poorly drained sites. Ground cover is varied. Stand openings on ridge tops have been invaded by bracken and wood fern, as well as balsam and birch regeneration. Speckled

alder, sheep laurel and Labrador tea are shrubs common to wet sites. Feather mosses carpet the ground within balsam fir stands. Sphagnum mosses are common within bogs.

Water Bodies - Some of the larger bogs have flarks that persist throughout the summer. Otherwise, no significant water bodies occur.

3.3.4 Ecosite 4 (Kennington Brook) (areal extent - 166 ha)

General Description - This ecosite encompasses the upper reaches of Kennington Cove Brook that fall within the Park boundary. The elevation gradually rises from 54 m a.s.l east of Munroe Lake to approximately 100 m a.s.l at the Park boundary east of Twelve Mile Lake.

Physiography - Much of the topography is very gently sloping. The ecosite receives constant seepage from adjacent uplands. The basal till has been reworked by the floodwaters of Kennington Cove Brook. Local accumulations of alluvial sands and silts are common. Soils are imperfectly to poorly drained with a high organic buildup being common. Gleysols and gleyed podzols predominate. Peat accumulations are found throughout the length of the Brook.

Vegetation - Balsam fir and black spruce dominate the forest cover of these poorly drained soils. In many places, tree growth is poor because of the consistently high water table and poor drainage. Larch forms a secondary component of the forest cover. Wetland shrubs such as sheep laurel, speckled alder, witherod and spirea are common. Other conspicuous plants include meadow-rue, water-cress and mint. Local ponding margins are characterized by arrowhead, cattails, and pickerel weed.

Water Bodies - This ecosite outlines the drainage

channel of Kennington Cove Brook from Twelve Mile Lake to east of Munroe Lake.

3.3.5 Ecosite 5 (Spectacle Hill) (areal extent - 63 ha)

General Description - This small ecosite comprises the hills immediately west of the Spectacle Lakes. Elevations vary between 78 m and 95 m a.s.l.

Physiography - The terrain is very hummocky with bedrock outcrops being common. A compact till of varying thickness is the dominant land cover. Soils are of sandy loam texture and well-drained to moderately well-drained. Seepage is common. These soils may be categorized as ferro-humic podzols. Organic soil buildup has occurred in depressions throughout the ecosite although large exposures of organic terrain do not occur.

Vegetation - Portions of this ecosite were ravaged by a wild fire years ago. The untouched forest cover consists primarily of balsam fir with black spruce, larch and tolerant hardwoods. The burnt areas consist of a myriad of shrubs including alder and witherod. White birch, red maple and balsam fir regeneration is prevalent.

Water Bodies - This ecosite borders the Spectacle Lakes. No permanent water bodies occur within the unit itself.

3.3.6 Ecosite 6 (Kennington Cove) (areal extent 558 ha)

General Description - This coastal ecosite stretches from Kennington Cove in the east to Deep Cove at the western end of the Park. The inland extent is approximately 1000 m from the coast. Elevations rise from sea level to 63 m a.s.l.

Physiography - A very rugged, steep coastline

characterizes this unit. Bedrock cliffs over 5 m in height rise sharply from deep waters. These cliffs are interspersed with bedrock protrusions with marked block fractures. Cobble beaches in small coves amongst the bedrock also occur. At Kennington Cove, near the eastern extremity of this ecosite, a gently grading sand beach some 200 m long with a backshore consisting of an abrupt till cliff is a vivid contrast to most of the coastline.

Much of the inland terrain is hummocky and gently sloping. A compact till, generally more than one meter deep, covers this ecosite although shallow till deposits over bedrock are found, particularly along the coast. Seepage along the interface with the underlying bedrock is prevalent. Soils are well-drained to moderately well-drained and may be categorized as ferro-humic podzols. Peatland depressions are minimal and scattered.

Vegetation - Except for lands adjacent Kennington Cove and a few old fields, the dominant vegetative cover consists of balsam fir stands. White spruce are prominent as scattered individuals within the old fields. Along the coast, the white spruce that do occur are small in height and contorted because of wind exposure. Black spruce is prevalent on poorly drained sites adjacent bogs. The hardwood component is minimal.

The Kennington Cove picnic site is characterized by an open grass field with scattered white spruce and balsam fir. Crowberry carpets the most exposed coastal lands. Common wood plants include wood fern, bracken fern and aralia in local clearings. Feather mosses form the dominant ground cover of the balsam fir stands.

Water Bodies - Several streams wind their way to the coast from adjacent uplands through this ecosite. Kennington Cove Brook is the largest and one of the two

major streams that flow through the Park. No permanent water bodies occur.

3.3.7 Ecosite 7 (Munroe Lake) - (areal extent - 419 ha)

General Description - This ecosite, centered around the Spectacle Lakes and Munroe Lakes, encompasses hummocky terrain west and south of Kennington Cove Brook. Elevations within the unit vary between 54 m and 84 m a.s.l.

Physiography - The hummocky topography has lead to development of many small bogs in poorly drained depressions. Most of the slopes are moderately, well-drained and seepage is common. Ferro-humic podzolic soils have developed from a compact sandy loam till. Gleysolic and organic soils form a substantial component of this ecosite.

Vegetation - Tree cover is varied. Balsam fir is prevalent. However, the black spruce and larch component of the forest cover is more evident within this site than adjacent units. White spruce and the intolerant hardwoods namely white birch and red maple, occur sporadically.

Feather mosses occupy much of the ground cover of balsam fir stands. Common shrubs under disturbed conditions and within the poorly-drained sites include sheep laurel, leather leaf and Labrador tea. Witherod and alder are also found throughout areas of logging disturbances and along local drainage channels throughout the ecosite.

Water Bodies - Munroe Lake and the two lakes that comprise the Spectacle Lakes fall within this ecosite. As well, Kennington Cove Brook, one of the two major drainage channels within the Park, borders the eastern boundary.

3.3.8 Ecosite 8 (Louisbourg Bog) (areal extent 238 ha)

General Description - This ecosite includes the larger inland bogs that occur within the Historic Park. The bogs are scattered throughout the Park with the largest single bogs occurring north of Lighthouse Point, and east of the access road to the Park headquarters.

Physiography - These bogs are generally less than three metres thick over till or bedrock. They are often gently sloping and have an irregular surface configuration. Pondings are present in a few of these bogs. The peat is largely a sphagnum peat with sedge peat remnants occurring at the contact with the underlying till or bedrock. Decomposition of the peat may be classified as messic within the range of H5 - H6 on the von Post scale although the deepest few centimetres are often decomposed to a scale of H9 - H10.

Vegetation - Sphagnum moss is the dominant ground cover. On the drier hummocks, lichens are conspicuous. Cotton grass is a common constituent as are several species of sedges. Common pond species include pond lilly and bogbean. Also present throughout the bogs are sheep laurel, bakeapple, bog cranberry, partridge berry and pitcher plant.

Water Bodies - Most of these bogs are not characterized by local pondings. However, there are a few bogs that have pondings that persist throughout the summer.

3.3.9 Ecosite 9 (Kennington Hills) (areal extent 238 ha)

General Description - This ecosite is segmented into four different areas bordering the upper reaches of Kennington Cove Brook. Elevations vary between 67 m and 103 m a.s.l. with the highest elevation being associated with the Kennington Hills east of Twelve Mile Lake.

Physiography - This upland ecosite is characterized by hummocky topography. A compact well-drained sandy, loam till covers the landscape. In places, the bedrock is near the surface. Peatlands are minimal and restricted to small localized depressions. Soils are well-drained and may be classified as ferro-humic podzols. Gleying is evident on imperfectly drained slopes.

Vegetation - Extensive areas of windfall occur within this ecosite. Balsam fir is the dominant tree species. White spruce, red maple, and white birch are present but form a minor component of the stand composition. Feather mosses carpet the ground of the dense balsam fir stands. In windfall areas, white birch, red maple, and balsam are regenerating. Bracken and wood fern are common. Other populous plants include wood sorrel, bunchberry, lily-of-the-valley and twinflower. Alders assume prominence in the poorly drained pockets.

Water Bodies - No significant water bodies occur.

3.3.10 Ecosite 10 (Kelly Lake Ridge) (areal extent - 104 ha)

General Description - This ecosite encompasses the hilly terrain extending southwards from Kelly Lake to the eastern shore of Cavanagh Lake. Elevations range from 69 m to 81 m a.s.l.

Physiography - Most of this ecosite consists of well-drained, sandy loam, compact till overlying hummocky bedrock. Bogs are minimal. Soils tend towards ferro-humic podzols. Seepage is minimal. Shallow soils over bedrock and bedrock outcrops are common.

Vegetative - Even-aged balsam fir (approximately 50 years old) cover this ecosite. White spruce and white birch form a main component with the balsam. Where windfall has opened the forest canopy, red maple and white birch, along with balsam fir, are rapidly establishing themselves. Where stand disturbance has occurred, bracken fern, wood fern and the common upland herbaceous plants are in evidence.

Water Bodies - No ponds or lakes occur although the ecosite is bordered by both Kelly and Cavanagh Lakes. The wetlands associated with Gerard Brook touch the eastern and southern boundaries.

3.3.11 Ecosite 11 (Cavanagh Lake) (areal extent - 679 ha)

General Description - This upland ecosite covers the terrain west of Kelly Lake, north of Cavanagh Lake and borders Landing Cover Brook ecosite to the south. It extends westwards beyond this ecosite to encompass Mathieson Lake and border the Kennington Hills. Elevations fall between 70 m and 90 m a.s.l.

Physiography - Hummocky topography with knolls interspersed by poorly drained depressions are characteristic. Compact, sandy loam to fine sandy loam till of varying depth is the predominant landform. Local bedrock outcrops occur with the shallow soils of the knolls and ridges. Peatlands with bog development overlie poorly-drained tills in depressional sites. Orthic and gleyed ferro-humic podzols occupy the better drained slopes and uplands.

Vegetation - Balsam fir forms the dominant forest cover. Larch, red maple and white birch are common associates with larch occupying much of the poorer drained soils. The intolerant hardwoods are most abundant as young saplings in windthrow areas and mixed with the open

stands of balsam. White spruce occurs sporadically and black spruce can be found largely along margins of peatlands.

Under closed stands of balsam, ground vegetation is restricted to a feather moss carpet. Bracken and New York fern are abundant in stand openings. Sheep laurel is a common shrub on organic soils. Common upland plants include wood sorrel, lily-of-the-valley, bunchberry, starflower and twinflower.

3.3.12 Ecosite 12 (Landing Cove Brook) (areal extent 300 ha)

General Description - This ecosite follows the floodplain and adjacent land of the upper reaches of Landing Cove Brook that fall within the Park boundary. Elevations range from a high of 87 m a.s.l. near Mathieson Lake to 48 m a.s.l. along the middle reaches of Landing Cove Brook.

Physiography - A complex of small knolls, poorly-drained depressions and moderately well-drained slopes make up this ecosite. Poorly drained bogs and alluvial deposits occur along Landing Cove Brook. The till cover is generally compact and seepage is common. Gleyed ferro-humic podzols, gleysols and organics characterize the majority of soils.

Vegetation - Along Landing Cove Brook, stands of balsam fir, interspersed with red maple, white birch and larch predominate. This forest cover is broken by the many small bogs and wet alder sites that occupy the wetter locations along the brook. Common shrubs along the floodplain are viburnum, spiraea and sweet gale. Vascular plants include blue flag, asters and meadow-rue. Interrupted and royal fern also occur frequently.

Adjacent uplands are characterized by common species such as bracken fern, wood sorrel, lily-of-the-valley,

bunchberry and starflower. Feather moss forms a ground carpet in many places.

Water Bodies - This ecosite is bordered by Cavanagh Lake to the east. Along Landing Cove Brook several small pondings, nourished by freshets induced by heavy rains or spring snow melt are present. Both Kelly and Cavanagh Lakes border this ecosite. Several ponds occur along the drainage chennel of Landing Cove Brook.

3.3.13 Ecosite 13 (Gerard Brook) (areal extent - 242 ha)

General Description - This ecosite encompasses the northeastern corner of the Park north of the Old French Road to the northern boundary. Elevations range between 22 m and 66 m a.s.l. with the lowest elevations occurring along the eastern boundary of the Park.

Physiography - The topography has a gradual slope from west to east with much of the terrain being hummocky in nature. Soils are generally deep and have developed from the compact, sandy loam to fine sandy loam till that covers much of the Park. These soils show podzolic development and except for local depressions are well-drained. Organic soils are scattered. Gleysols and regosols occur adjacent Gerard Brook.

Vegetation - Balsam fir is the dominant tree cover. Stand ages vary although ages over seventy are rarely attained. Red maple and white birch are common associates of mixed stands with balsam. Both black and white spruce form a minimal component of this ecosite. Peatland vegetation is concentrated adjacent the stream channels. Under closed stands ground vegetation is minimal.

Bracken fern and New York fern assume prominence in stand openings. Other common upland plants include wood fern, bunchberry starflower, lily-of-the-valley and wood sorrel.

Water Bodies - No ponds or lakes occur. The major drainage channel is Gerard Brook.

3.3.14 Ecosite 14 (Simon White Point) (areal extent - 268 ha)

General Description - This coastal ecosite extends westwards from Louisbourg Bog to Kennington Cove just beyond Simon Point. It reaches inland to roughly parallel the Kennington Cove access road. Elevations rise from sea level to approximately 36 m a.s.l.

Physiography - A complex of knolls, irregular ridges and small depressions characterizes much of the terrain. The coastline varies from rugged, fractured bedrock outcrops to gently sloping cobble and gravel beaches. A compact, sandy loam till interspersed by local depositions of shallow soil over bedrock is prevalent. Soils are gleyed and orthic ferro-humic podzols. A discontinuous plagic layer is present. Poorly drained depressions have gleysolic soils.

Vegetation - Near the coast white spruce and balsam fir have developed dense stands rarely exceeding three to four metres in height. Crowberry barrens occur at Simon Point and along the eastern coastal boundary. Local depressions are characterized by bog vegetation with stunted balsam fir and black spruce growth. Alders assume prominence in wet clearings and windfall areas. Adjacent the Kennington Cove Road and inland, white spruce gives way to stands of balsam fir with some white birch, red maple and larch.

Ground vegetation is dependent on density of tree cover, local drainage characteristics and coastal influences. Crowberry is common along the exposed coastline. Cinnamon fern, bracken fern, sarsaparilla, bunchberry and lily-of-the-valley are all common associates inland from the coast.

Water Bodies - Several coastal ponds of varying sizes are present along the shoreline from Simon Point eastwards. Landing Cove Brook (Freshwater Brook) flows to the coast through this unit.

3.3.15 Ecosite 15 (Fortress) (areal extent - 115 ha)

General Description - This ecosite is the second smallest unit delineated within the Park. It is a coastal ecosite that covers both Rochefort Point and Black Point and includes the restoration site of the Fortress. Elevations range from sea level to 9 m a.s.l. Man-made ramparts and earthworks exceed this elevation.

Physiography - The fields about the fortress are gently rolling to hummocky. The shoreline is characterized by gravel beaches interspersed amongst rugged, blocky, coastal bedrock. The site of the Fortress of Louisbourg and its fortification covered this ecosite. Thus, man-induced activities have greatly altered the surface soils and landforms. A compact till does occur at close to a metre below the surface in places. Black Point is predominantly bedrock at the surface.

Vegetation - This ecosite is void of tree cover. The fields beyond the current restoration site consist largely of various grasses, mosses, herbs, and various ericaceous shrubs. In the sheltered areas, Angelica assumes prominence.

Water Bodies - Several small coastal ponds occupy local depressions within this unit. One large pond adjacent the Fortress is separated from Louisbourg Harbour by an artificially reinforced coastal barrier.

3.3.16 Ecosite 16 (Louisbourg Harbour) (areal extent 270 ha)

General Description - This ecosite occupies the western shore of Louisbourg Harbour. It extends inland approximately 1100 m at its deepest penetration. The elevation rises from sea level to 50 m. a.s.l.

Physiography - This coastal ecosite is characterized by rolling to gently sloping topography. Soils are predominantly ferro-humic podzols and gleysols. Seepage at the contact with the compact underlying till is common. Along the coast, much of the tree cover has been cleared for farming; this land has subsequently been abandoned.

Vegetation - Along the coast the abandoned fields are occupied by a variety of herbs and shrubs. Alder, sweet gale and sheep laurel are common shrubs. Asters and goldenrods are plentiful as is the introduced Angelica. Inland, beyond the fields, balsam fir again is dominant. White spruce, white birch, red maple and larch form a minor component over much of the wooded sections. Carpets of Schreber's moss and Hylocomium moss occupy the floor of the balsam stands. The more open stands may have a wide variety of ground cover. Cinnamon, bracken and wood fern are common as are herbs such as bunchberry, starflower, sarsaparilla and lily-of-the-valley.

Water Bodies - No significant water bodies are present.

3.3.17 Ecosite 17 (Louisbourg) (areal extent - 1,127 ha)

General Description - This ecosite is the largest delineated unit within the Park. It encompasses a goodly portion of the eastern section of the Park north of the Kennington Cove Road extending westwards to Kennington Cove Brook and north to the Old French Road. Elevations rise from a low of approximately 27 m a.s.l. near the Kennington Cove Road to over 76 m a.s.l. in the central highlands of the Park.

Physiography - This upland ecosite is characterized by hummocky to gently rolling topography covered by a generally compact, well-drained, deep till. Textures vary from gravelly, sandy-loam to fine sandy loam. Ferro-humic podzols dominate. Seepage is common and, where local

drainage is impeded, gleying is common. Gleysolic soils prevail in poorly drained depressional areas. Small bogs are common throughout.

Vegetation - Stands of balsam fir of varying age and density dominate. White birch and red maple form mixed stands with balsam, particularly along the height of land through this ecosite. Black spruce becomes a major associate on poorly drained hillsides and vales. Both eastern larch and white spruce occur sporadically throughout; localized concentrations of white spruce are found in the disturbed stands and open field situations near the main access roads along the perimeter of this ecosite.

Ground vegetation is varied both in species composition and density. Thick balsam stands have minimal ground flora. Common ferns include cinnamon fern, bracken fern, New York fern, interrupted fern and wood fern. Lily-of-the-valley, starflower, wood sorrel, clintonia, bunchberry, goldthread and twinflower are common throughout the uplands. Meadow-rue, blue iris, sweet fern, sweet gale and witherod occupy many of the moist sites.

Water Bodies - Two major creeks pass through or border this ecosite - Landing Cove Brook and Kennington Cove Brook. There are no lakes although local pondings occur along Landing Cove Brook.

3.3.18 Ecosite 18 (Lighthouse Point) (areal extent - 132 ha)

General Description - This ecosite encompasses all coastal lands and adjacent uplands of the Park from Louisbourg Harbour beyond Lighthouse Point to the western boundary of Ecosite 19. Elevations rise from sea level to 36 m a.s.l. at the height of land inland from Lighthouse Point.

Physiography - The coastal lands of this ecosite are very similar to ecosites 19 and 20 with steep rugged cliffs dominating. Gravel beaches are found in the local coves. The upland topography is undulating. A compact sandy loam till overlies the bedrock throughout except near the coast where exposed bedrock outcrops are common. Coastal soils are predominately ferro-humic podzols. In places where organic build-up through the upper layers of the soil profile has occurred, these soils tend towards classification as humic podzols. A placic layer in the podzols is common.

Vegetation - Crowberry dominates the coastline. Coastal balsam fir stands are stunted and thick rarely attaining a height over 5 m. Inland, white birch and red maple form a minor component of the forest stand. Black spruce and larch are scattered throughout this ecosite.

Ground vegetation is restricted to a carpet consisting chiefly of feather mosses in the dense balsam stands. Other common plants include wild lily-of-the-valley, clintonia, starflower and bunchberry. In open disturbed sites, bracken fern, sarsaparilla, wood fern and various asters and goldenrods assume prominence.

Water Bodies - Local pondings are minimal.

3.3.19 Ecosite 19 (Lorraine) (areal extent - 154 ha)

General Description - This ecosite extends west from Hammer Head to the northern boundary of the Park. Its common boundary with ecosite 18 parallels a drainage channel that extends from the Park boundary to the coast. Elevations range from sea level to 37 m. a.s.l.

Physiography - Hummocky topography prevails. Bogs are scattered throughout the ecosite. The terrain is bedrock-controlled and a shallow till layer is prevalent.

Orthic and gleyed ferro-humic podzols are common. The many depressions are characterized by soils ranging from gleysols to the typical bog mesisols and humisols.

Vegetation - Balsam fir is the dominant tree species and, except for the peatlands, is prevalent throughout the ecosite. This fir is small and contorted along the fringes of the coastal crowberry barrens. Inland, it is found in association with white birch, white spruce and larch in the wetter sites and along drainage channels. Windfall is prevalent.

Along the coast, crowberry carpets dominate. Inland, in windfall areas sarsaparilla, bracken fern, wood fern, and witherod persist. Bunchberry and starflower occur in the more dense fir stands. The slope bogs have a diverse plant composition with the more common plants and shrubs being bog rosemary, sheep laurel, leather leaf, pitcher plant and a variety of Sphagnum mosses.

Water Bodies - No significant lakes or streams occur. Some of the bogs have pondings.

3.3.20 Ecosite 20 (Hammer Head) (areal extent - 144 ha)

General Description - This ecosite encompasses the easternmost coastal lands of the Historic Park. It includes the coastal heathlands and Hammer and Lorraine Head, the old fields adjacent to Big Lorraine and the connecting hummocky inland terrain. Elevations range from sea level to 25 m a.s.l.

Physiography - Rugged cliffs interspersed with small gravel beaches characterize the coastline. The adjacent barrens are hummocky and have little or no soil cover. Exposed bedrock is common. Shallow bogs have developed over bedrock in local depressions. Inland of the coastal barrens, rounded bedrock knolls predominate. Bog development (generally deeper than the coastal bogs) is prevalent throughout the depressions amongst these rock outcrops.

Soils are shallow throughout and where deposits of till mantle the bedrock, ferro-humic podzols have developed. The till is compact, of gravelly, sandy loam texture and imperfectly to moderately well-drained. Mesic soils characterize the slope bogs.

Vegetation - The coastal heathlands are dominated by crowberry. Other common associates include lichens and sphagnum carpets with bog cranberry and blueberry. The open fields along the eastern Park boundary are characterized by a variety of shrubs, including one of the largest concentrations of Angelica found within the Park. Common shrubs include sweet gale, witherod, spirea and speckled alder. Balsam fir regeneration is rampant. Inland, juniper, in matted form, is common on the bedrock knolls. The forested land consists mainly of balsam fir. The stands are thick in places and often distorted because of exposure to prevailing on-shore winds. Stand openings are common with bracken fern, sarsaparilla and wood fern being predominant ground flora.

Water Bodies - Local ponding occurs sporadically in catchment basins within the crowberry coastal barrens. One sizeable unnamed lake occurs along the boundary with Ecosite 19. The inland bogs are generally void of ponds although a sizeable pond occurs within the large bog-rock knoll complex at the height of land of this ecosite.

3.3.21 Ecosite 21 (Fortress Bog) (areal extent - 91 ha)

General Description - This ecosite consists of two relatively large coastal bogs located near the reconstruction site of the Fortress. The larger of the two bogs is situated immediately south and west of the restoration site and the smaller wetland stretches from the coast to Kennington Cove Road just beyond the southern gate to the Fortress. These bogs rise in ele-

vation from near sea level to local hummocks that are approximately 12 m a.s.l.

Physiography - This wetland ecosite can be characterized as a raised bog. Depth to bedrock of the peat varies but does not exceed 2.5 m. Probes indicate that the peat overlies the bedrock directly. Surface expression is slightly hummocky with local flarks tending towards a concentric pattern. General peat profile development indicates an upper fibric-mesic layer extending to 100 cm and a sedge-woody humic peat to bedrock. Humic tiers approach the surface near the edges of the bog and in local fen-type pockets within the bog.

Vegetation - Sphagnum mosses dominate these two bogs. Other common ombrotrophic species include bog laurel, bake-apple, bog cranberry, bog rosemary, pitcher plant and sundew. The most common grass is cotton grass. Tree cover is minimal with stunted black spruce occurring sporadically. The larger shrubs, the alders, spirea and sweet gale are found adjacent to the large ponds.

Water Bodies - Both bogs are characterized by pondings. With the exception of the large pond in the bog immediately adjacent the Fortress, these ponds dry out during the summer.

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APPENDIX I

GLOSSARY OF TERMS

ACID SOIL:	A soil material having a pH of less than 7.0
ALLUVIUM:	Material such as clay, silt, sand and gravel deposited by modern rivers and streams
BRECCIA:	A rock composed of coarse angular fragments cemented in a fine-grained matrix
DIATOMS:	Algae having siliceous cell walls that persist as a skeleton after death. These microscopic, unicellular or colonial algae are abundant in both fresh and salt waters and their remains are widely distributed in soils
ELUVIATION:	The transportation of soil material in suspension or solution within the soil by the downward or lateral movement of water
ERICACEOUS:	Relating to or being of the heath family of plants
FIBRISOL:	An organic soil consisting of organic soil materials which are readily identifiable as to botanical origin. Fibric material is bulky and has low density and a high water holding capacity
FLOODPLAIN:	The land bordering a stream built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage
FLUVIAL DEPOSITS:	All sediments past and present, deposited by flowing water including glaciofluvial deposits
GLACIAL DRIFT:	All rock material carried by glacier ice and glacial meltwater. This term includes till
GLACIOFLUVIAL DEPOSITS:	Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melted ice. The deposits are stratified

GLEYSATION: A soil forming process operating under poor drainage conditions, which results in the reduction of iron and other elements and in gray colors and mottles

GLEYSOL: Soil that occupies depressional areas of the landscape and is saturated with water for extended periods of time throughout the year

GREAT GROUP: A category in the Canadian System of Soil Classification. It is a taxonomic group of soils having certain morphological features in common and a similar pedogenic environment

HORIZON, SOIL A layer of soil or soil material approximately parallel to the land surface; it differs from adjacent genetically related layers in properties such as colour, structure, texture, consistence and chemical, biological and mineralogical composition.

The following mineral horizons occur:

A - A mineral horizon formed at or near the surface in the zone of removal of materials in solution and suspension, or maximum in situ accumulation of carbon, or both

B - A mineral horizon characterized by one or more of the following:

1) an enrichment in silicate clay, iron, aluminum or humus

2) a prismatic or columnar structure that exhibits pronounced coatings or stainings associated with significant amounts of exchangeable sodium (does not occur in the Maritimes)

3) an alteration by hydrolysis reduction or oxidation to give a change in color or structure from the horizons above or below

C - A mineral horizon comparatively unaffected by the pedogenic processes operative in A and B except gleying and the accumulation of carbonates and more soluble salts

INDICATOR PLANT: Plant that is characteristic of a specific soil or site condition

INTOLERANT TREE SPECIES: A tree that cannot survive and prosper under a forest canopy. It thrives only in the main canopies or in the open.

MESISOL: An organic soil consisting of organic soil materials which are at an intermediate stage of decomposition. Botanical origin is recognizable but not readily evident as with a fibrisol

MORAINE: An accumulation of earth generally with stones, carried and finally deposited by a glacier

MOTTLES: Spots or blotches of different colour or shades of colour interspersed with the dominant colour

PARENT MATERIAL: The unconsolidated and more or less chemically weathered mineral or organic matter from which the soil profile has developed by pedogenic processes

PEDOLOGY: The aspects of soil science dealing with the origin, morphology, genesis, distribution, mapping and taxonomy of soils and classification in terms of their use

pH The intensity of acidity or alkalinity expressed as the logarithm of the reciprocal of the H+ concentration. pH 7 is neutral, lower values indicate acidity and higher values alkalinity

PIONEER TREE SPECIES: A tree capable of establishing itself in a bare or barren area or in open condition and initiating an ecological cycle

PLACIC: Pertaining to a thin black to dark reddish horizon and presumably cemented by iron

PODZOL, FERRO-HUMIC:	Soils that have developed under the influence of forest or heath vegetation in areas with relatively cold and humid climatic conditions. They have a dark-coloured podzolic B horizon with a high content of organic C
PODZOL, HUMIC:	Soils that have developed in wet sites so that they are saturated with water during some periods of the year. They are found under maritime heath and forest vegetation. The B horizon is dark-coloured
SEEPAGE:	(i) The escape of water downward through the soil (ii) The emergence of water from the soil along an extensive line of surface in contrast to a spring where water emerges from a local spot
TILL:	Unstratified glacial drift deposited directly by the ice and consisting of clay, sand, gravel and boulders intermingled in any proportion
TOLERANT TREE SPECIES:	A tree that can survive and prosper under a forest canopy
WATER TABLE	The upper limit of the part of the soil or underlying rock material that is wholly saturated with water

APPENDIX II

Check List of Plants Identified Within Fortress of Louisbourg National Historic Park

Vascular Plants

Abies balsamea (balsam fir)
Acer pensylvanicum (moose maple)
Acer rubrum (red maple)
Acer saccharum (sugar maple)
Achillea millefolium (yarrow)
Alnus rugosa (speckled alder)
Amelanchier Bartramiana (juneberry)
Anaphalis margaritacea (pearly everlasting)
Andromeda glaucophylla (bog rosemary)
Angelica atropurpurea (Angelica)
Angelica sylvestris (Angelica)
Aralia hispida (bristly aralia)
Aralia nudicaulis (sarsaparilla)
Arctium minus (burdock)
Arctostaphylos uva-ursi (bearberry)
Arenaria lateriflora (stitchwort)
Arethusa bulbosa (arethusa)
Aronia melanocarpa (chokeberry)
Aronia prunifolia (chokeberry)
Artemisia Absinthium (artemesia)
Aster acuminatus (aster)
Aster borealis (aster)
Aster nemoralis (aster)
Aster umbellatus (aster)
Betula alleghaniensis (yellow birch)
Betula papyrifera (white birch)
Bidens frondosa (beggar-tick)
Calamagrostis canadensis (blue-joint)

Vascular Plants (cont'd)

Calamagrostis inexpansa (reed grass)
Calapogon puchellus (calapogon)
Capsella Bursa-pastoris (shepherd's purse)
Carex spp. (sedges)
Carum carvi (caraway)
Chamaedaphne calyculata (leather leaf)
Chelone galabra (turtlehead)
Chrysanthemum leucanthemum (ox-eye daisy)
Cicuta maculata (water hemlock)
Circaea alpina (enchanter's nightshade)
Cirsium arvense (thistle)
Cirsium muticam (thistle)
Cirsium vulgare (thistle)
Clintonia borealis (clintonia)
Coptis trifolia (goldthread)
Cornus canadensis (bunchberry)
Crepis capillaris (hawk's beard)
Cypripedium acaule (common lady's slipper)
Cypripedium reginae (showy lady's slipper)
Diervilla Lonicera (bush-honeysuckle)
Drosera intermedia (sundew)
Drosera rotundifolia (sundew)
Dryopteris noveboracensis (New York fern)
Dryopteris Phegopteris (beech fern)
Dryopteris spinulosa (wood fern)
Empetrum nigrum (crowberry)
Epifagus virginiana (beech-drops)
Epigaea repens (mayflower)
Epilobium augustifolium (willow-herb)
Epilobium palustre (willow-herb)

Vascular plants (cont'd)

Equisetum arvense (horsetail)
Erigeron canadensis (horseweed)
Eriophorum angustifolium (cotton-grass)
Eriophorum virginicum (cotton-grass)
Eupatorium maculatum (Joe-pye-weed)
Eupatorium perfoliatum (boneset)
Euphrasia americana (eyebright)
Frageria vesca (strawberry)
Frageria virginiana (strawberry)
Galium asprellum (bedstraw)
Galium boreale (bedstraw)
Galium triflorum (bedstraw)
Gaultheria hispidula (snowberry)
Gaultheria procumbens (wintergreen)
Gaylussacia baccate (huckleberry)
Gaylussacia dumosa (bog huckleberry)
Gylceria borealis (manna-grass)
Gylceria grandis (manna-grass)
Gnaphalium uliginosum (cudweed)
Goodyera repens (rattlesnake plantain)
Habenaria blephariglottis (white-fringed orchid)
Habenaria clavellata (club-spurr orchid)
Habenaria lacera (ragged-fringed orchid)
Helianthemum canadense (frostweed)
Hieracium aurantiacum (hawkweed)
Hieracium paniculatum (hawkweed)
Hieracium canadense (hawkweed)
Hydrocotyle americana (pennywort)
Hypericum boreale (St. John's-Wort)
Hypericum canadense (St. John's-Wort)
Hypericum perforatum (St. John's-Wort)

Vascular Plants (cont'd)

Hypericum virginicum (St. John's-Wort)
Iris prismatica (blueflag)
Iris versicolor (blueflag)
Juncus canadensis (rush)
Juniperus communis (ground juniper)
Kalmia angustifolia (sheep laurel)
Kalmia polifolia (pale laurel)
Lactuca canadensis (wild lettuce)
Lamium album (dead nettle)
Larix laricina (eastern larch, tamarack)
Lathyrus japonicus (beach pea)
Ledum groenlandicum (Labrador-tea)
Leontodon autumnalis (fall dandelion)
Linnaea borealis (twinflower)
Listera cordata (twayblade)
Lycopodium annotinum (club-moss)
Lycopodium clavatum (club-moss)
Lycopodium obscurum (club-moss)
Lycopus americanus (water horehound)
Lysimachia terrestris (loosestrife)
Lythrum Salicaria (purple loosestrife)
Maianthemum canadense (lily-of-the-valley)
Malaxis unifolia (green adder's-mouth)
Matricaria maritime (matricaria)
Matricaria matricarioides (matricaria)
Medeola virginiana (indian cucumber-root)
Mentha arvensis (mint)
Menyanthes trifoliata (buckbean)
Mertensia maritima (bluebell)
Millegrana Radiola (tiny all-seed)
Mitchella repens (partridge berry)

Vascular Plants (cont'd)

Molinia caerulea (moor-grass)
Monotropa hypopithys (pine-sap)
Monotropa uniflora (indian pipe)
Myrica Gale (sweet gale)
Myrica pensylvanica (bayberry)
Nemopanthos mucronata (false holly)
Nuphar variegatum (cow lily)
Oenothera biennis (sundrops)
Onoclea sensibilis (sensitive fern)
Orchis rotundifoliata (orchis)
Osmunda cinnamomea (cinnamon fern)
Osmunda Claytoniana (interrupted fern)
Osmunda regalis (royal fern)
Oxalis montana (wood sorrel)
Pastinaca sativa (wild parsnip)
Phleum pratense (timothy)
Picea glauca (white spruce)
Picea mariana (black spruce)
Pinus strobus (white pine)
Plantago juncoides (rib-grass)
Plantago lanceolata (rib-grass)
Poa compressa (Canada bluegrass)
Polygonum coccineum (knotweed)
Polygonum lapathifolium (knotweed)
Polygonum Persicaria (knotweed)
Polygonum sagittatum (knotweed)
Pontederia cordata (pickeral weed)
Populus tremuloides (trembling aspen)
Potamogeton spp (pondweeds)
Potentilla Anserine (silver weed)
Potentilla canadensis (cinquefoil)
Potentilla fruticosa (shrubby cinquefoil)

Vascular Plants (cont'd)

Potentilla norvegica (cinquefoil)
Potentilla palustris (marsh cinquefoil)
Potentilla recta (cinquefoil)
Potentilla simplex (cinquefoil)
Potentilla tridentata (cinquefoil)
Prenanthes trifoliolata (lion's paw)
Prunella vulgaris (heal-all)
Prunus pensylvanica (pin cherry)
Prunus virginiana (choke cherry)
Pteridium aquilinum (bracken)
Pyrola elliptica (shinleaf)
Pyrola rotundiflora (shinleaf)
Ranunculus abortivus (buttercup, crowfoot)
Ranunculus acris (buttercup)
Ranunculus bulbosus (buttercup)
Ranunculus repens (buttercup)
Rhinanthus Crista-galli (yellow rattle)
Rhododendron canadense (rhodora)
Rosa nitida (swamp rose)
Rosa palustris (rose)
Rosa rugosa (rose)
Rosa virginiana (common wild rose)
Rubus hispidus (trailing blackberry)
Rubus pubescens (dwarf raspberry)
Rubus strigosus (wild red raspberry)
Rudbeckia hirta (black-eyed susan)
Rumex acetosella (sheep-sorrel)
Sagittaria latifolia (arrow-head)
Salix spp. (willows)
Sambucus canadensis (common elder)
Sanguisorba canadensis (burnet)
Sarracenia purpurea (pitcher plant)
Scirpus cespitosus (bullrush)

Vascular Plants (cont'd)

Sedum acre (stonecrop)
Senecio vulgaris (groundsel)
Smilacina racemosa (false Solomon's seal)
Smilacina stellata (false Solomon's seal)
Solidago bicolor (goldenrod)
Solidago canadensis (goldenrod)
Solidago nemoralis (goldenrod)
Solidago uliginosa (bog goldenrod)
Sonchus arvensis (thistle)
Sonchus asper (thistle)
Sorbus americana (mountain ash)
Spiraca latifolia (meadowsweet)
Spiranthes cernua (ladies' tresses)
Spiranthes grucilis (ladies' tresses)
Spiranthes Romanzoffiana (ladies' tresses)
Stellaria media (stitchwort)
Streptopus roseus (twisted stalk)
Succisa pratensis (devil's-bit)
Taraxacum officinale (dandelion)
Thalictrum polygamum (meadow-rue)
Trientalis borealis (star-flower)
Trifolium agrarium (hopclover)
Trifolium hybridum (alsike clover)
Trifolium pratense (red clover)
Trifolium repens (white clover)
Trillium undulatum (painted trillium)
Tussilago Farfara (coltsfoot)
Typha angustifolia (cattail)
Typha latifolia (cattail)
Utricularia cornuta (bladderwort)
Utricularia geminiscapa (bladderwort)
Utricularia vulgaris (bladderwort)

Vaccinium angustifolium (low bush blueberry)
Vaccinium macrocarpon (large cranberry)
Vaccinium myrtilloides (Canada blueberry)
Vaccinium oxycoccus (small cranberry)
Vaccinium vitis-idaea (cowberry)
Verbascum Thapsus (mullein)
Veronica officinales (speedwell)
Viburnum cassinoides (witherod)
Viburnum edule (squashberry)
Vicia americana (vetch)
Vicia Cracca (tufted vetch)
Viola blanda (sweet white violet)
Viola cucullata (blue violet)
Viola lanceolata (lance-leaved violet)
Viola pallens (white violet)

Bryophtes

Cephalozia media
Cladopodiella fluitans
Dicranum drummondii (moss)
Dicranum scoparium (broom moss)
Dicranum undulatum (wavy dicranum moss)
Hypnum crista-castrensis (plume moss)
Pleurozium schreberi (Schreber's moss)
Pohlia nutans (nodding pohlia)
Polytrichum commune (hair-cap moss)
Sphagnum cuspidatum
Sphagnum imbricatum
Sphagnum Flavicomans
Sphagnum fuscum
Sphagnum magellanicum
Sphagnum majus
Sphagnum papillosum

Bryophtes (cont'd)

Sphagnum pulchrum
Sphagnum pylaesii
Sphagnum rubellum
Sphagnum tenellum

Lichens

Cetraria ciliaris
Cetraria islandica
Cladonia alpestris
Cladonia arbuscula
Cladonia boryi
Cladonia mitis
Cladonia rangiferina
Cladonia uncialis