PROCEEDINGS

OF THE

Nova Scotian Institute of Science

VOL. 26, PART 4, 1969

THE FLORA OF NOVA SCOTIA

PART 2

THE DICOTYLEDONS

A. E. ROLAND

Nova Scotia Agricultural College, Truro, Nova Scotia

and

E. C. SMITH

Perry Biological Laboratories, Acadia University,
Wolfville, Nova Scotia

CONTENTS

INTRODUCTION

The aim of this work is to give a treatment of the native and introduced plants growing without cultivation in Nova Scotia, to bring up to date the nomenclature, and to provide a means of identification for the various species, varieties and forms that have been found in this region.

The order of the families, genera and species is that used in Gray's Manual of Botany (8th ed. Fernald, 1950-a). Specific and subspecific names derived from proper nouns are capitalized. Abbreviations of authorities for the scientific names follow that of Gray's Manual. An X in front of the scientific name denotes that the plant is a hybrid. The chromosome number is given only when it has been determined for collections from our area and for each case the number is the sporophytic (2n) number. The general ranges of the plants have been obtained from recent monographs or floras, with the Canadian ranges checked with that given by Boivin (1966, 1967).

Keys to the families, genera and species have been revised and somewhat amplified so as to give a better description and provide an easier means of identification; short descriptions of families and genera have been added as space permits. It is hoped that this will make this treatment more useful for those who do not have other manuals available.

The distribution maps have been based upon those appearing in the first edition and are brought up to date with the new dots representing recent herbarium collections. In general those species have been mapped which show an unusual or interesting range. Only a few maps show a general distribution and these have been included to show how many collections have been made. Additional maps have been added in cases where the ranges of the rarer plants have become better known. In some maps the relative abundance of the plants in different parts of the Province has been obscured because of the tendency to make more collections in a region where a plant is rather rare. The distribution of the plants in Prince Edward Island has been added to the maps from data of D. S. Erskine (1960) but no special effort has been made to give the distribution in New Brunswick and this is shown only when the data were easily available.

The tendency in respect to the scientific names is to consider each kind of plant as a species when, in some cases at least, it might be better to regard them as subspecies or even as varieties of plants with continental or circumboreal ranges. In most cases this relationship is mentioned in the text.

The general references to the flora of Nova Scotia and the publications of local botanists are given in the bibliography at the end of the book. Those concerned with a single group, genus or species are cited where the plants are described. No attempt has been made to give all

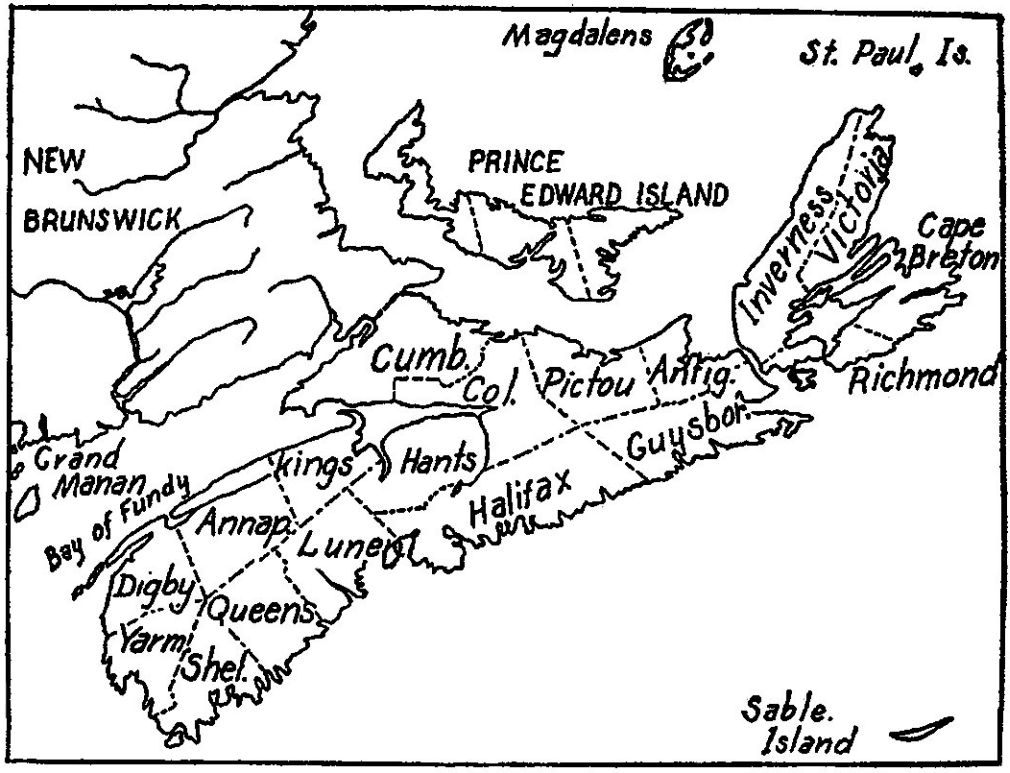
the references but the principal ones concerning local plants and the ones which have been found useful in compiling keys and in revising the taxonomy have been included. Rhodora, the journal of the New England Botanical Club, has been found particularly useful.

Appreciation must be expressed to the Nova Scotia Department of Agriculture, and to the Nova Scotia Research Foundation, whose continual support made much of the field work possible and provided the time to make the maps and drawings and to complete the text. A grant from the National Research Council of Canada provided assistance for the final checking and writing. The acknowledgements in the introduction to Part I apply even more to Part II. The herbarium of the Nova Scotia Museum at Halifax provided much information on the distribution of our plants and special reference must be made to Mr. J. S. Erskine who collected in many out-of-the-way parts of the Province and provided so many new and interesting records of our native plants. Finally, the authors would like to express their appreciation to the Nova Scotian Institute of Science for providing a means of publication, without which much of their work would have little permanent value.

We dedicate this work to Dr. Muriel V. Roscoe of Acadia University and to the late Professor H. P. Bell of Dalhousie University for their inspiration, interest and help during and since our student days.

THE PHYSICAL BACKGROUND

Nova Scotia lies between 43° and 47° north latitude with the axis running in a general north-east south-west direction. It has a length of about 340 miles and an average width of 50 miles; it consists of a peninsula joined to the mainland by the low swampy Isthmus of Chignecto, and the Island of Cape Breton separated from the eastern end of the peninsula by the narrow Strait of Canso. Two small islands, extensively explored botanically, lie off Cape Breton. St. Paul Island is a few miles north of the northern tip; and Sable Island, a narrow sandy bar 20 miles long, is one hundred miles to the southward. The province is divided into 18 counties as shown in map A.



Map A—Map of Nova Scotia showing the counties.

Geologically the province is the up-tilted and eroded surface of an old Cretaceous peneplain. This dips below the surface of the Atlantic Ocean to produce the drowned and very irregular coast-line, and rises gradually and evenly to the northward to attain in the highlands of northern Cape Breton and southern New Brunswick a height of 1200 feet. The weaker rocks and structures of the northern area have worn away so that the province, which is flat, sterile and poorly-drained along the Atlantic Coast, becomes increasingly hilly and irregular inland.

Map B—Physiographic features as explained in text.

Map B shows the main physiographic areas of the province. The unshaded area comprising nearly the southern half of the area is called the Atlantic Upland. This is composed of very resistant rocks, slates, quartzites and granites and it is not essentially an upland but rather gently rises from sea-level at the southern edge to a height of 100 to 500 feet at its northern boundary. The western half of this upland has the three main types of rocks in about equal proportions, with the areas of slate appearing in southern Yarmouth, central Queens and in Lunenburg counties while the eastern half is mainly granites and quartzites. The topography is of slight relief, and innumerable lakes, streams, bogs, barrens and stillwaters occur.

The shaded areas comprise the true uplands of the province. The long range, or North Mountain, from Kings County to Digby County, is composed of basalt or trap rock which gradually falls from a height of nearly 600 feet at its eastern end until it dips beneath the sea at the southern end of Digby Neck. From western Cumberland County to northern Cape Breton occur ranges of hills and highlands composed of igneous rocks, syenites, diorites, and granites. Those occurring from Cumberland County to Pictou County, known as the Cobequid Mountains, rise to 1000 feet and are covered mostly with deciduous forest;

the broad plateaus of northern Cape Breton, often attaining a height of 1400 feet, have a much poorer drainage, a more severe climate, a shorter growing season, and are covered with bogs, swamps, and coniferous trees.

The vertically hatched areas are lowlands of Carboniferous to Triassic age very diverse in character. The Annapolis Valley from Digby County to Kings County is carved from Triassic sandstone; the northern and eastern lowlands have various mixtures of sandstones, shales, conglomerates, limestones and gypsum. Extensive intervales occur; deep valleys and rugged cliffs are found next to the uplands; and lakes and ponds are relatively few.

The climatic data are given in Putnam (1940). The southwestern part of the province shows a longer frost-free period, lower July temperatures, more foggy days per year, and a higher minimum winter temperature than the other regions. The Island of Cape Breton differs markedly in having a shorter growing season. The temperature and the number of fog-free days, of the coastal regions at least, are also low throughout the year.

The soils of the province have now been studied in detail. Although the region has been wholly glaciated they show close correlation with the underlying rocks. The soils of the granitic and quartzite areas are thin and rocky. Extensive sand areas occur in the Annapolis Valley and in Cumberland County. The undulating or hilly areas are usually well-drained with deep soils; but much of the lowlands of northern and eastern Nova Scotia have soils heavy in texture and of poor drainage. Near the coast extensive peat bogs and swamps occur and raised *Sphagnum* bogs are common in Guysborough County and in Cape Breton.

HISTORICAL ASPECTS AND HERBARIA

Recorded knowledge of the flora of Nova Scotia started with the first number of the Transactions of the N. S. Institute of Science published in 1863. Before this time there had been only general observations and scattered lists. Haliburton's Historical and Statistical Account of Nova Scotia of 1829 contained a section on our native plants; and Titus Smith included observations on the vegetation of western Nova Scotia in an unpublished manuscript in 1801, as well as writing the text for a book on flowers illustrated by colored plates painted by Maria Morris (see Gorham, 1955). However, no comprehensive work on the plants had been undertaken. The publication of the Transactions provided, for the first time, a medium of publication to bring together the scattered information for general reference.

About this time several workers in different parts of the Province began to make systematic collections of plants, — H. How at Windsor, A. H. MacKay in the neighborhood of Pictou, A. W. H. Lindsay in the

eastern part of the Province, and E. H. Ball at various places where he held pastorates. Many of these collections are still preserved in the Provincial Museum at Halifax. In general they consist of the common plants of the Province, usually correctly named, but in some cases misidentified.

The results of this early work were gathered together by Lindsay (1875–6) in his Catalogue of the Flora of Nova Scotia. This remained as the only attempt to bring together a comprehensive list of the plants of the Province until the "Flora of Nova Scotia" was printed (Roland, 1944–6).

Most of the papers published subsequent to Lindsay's catalogue have been lists of plants collected in scattered localities throughout the Province or they have been notes upon rare or unusual plants. How (1876-7) compiled additions to Lindsay's list; Lawson (1882-3, 1890-1) noted the occurrence of other rare plants; Campbell, (1884-5, 1885-6) listed the plants found in the vicinity of Truro; Cox (1893-4) did likewise for Shelburne; Robinson (1901-2, 1907) noted plants collected in eastern Nova Scotia, and especially intervale plants; Fowler (1902-5) reported on the plants of Canso; Barbour (1905-6) listed some plants of MacNab's Island in Halifax Harbour; and Prest (1904-5) discussed the edible plants of the Province. Many of the discoveries of these early botanists, as well as the numerous collections from northern and eastern Nova Scotia of John Macoun himself, were reported or listed in Macoun's Catalogue of Canadian Plants (1883-1902).

The ferns were perhaps the most intensively studied. Ball (1875-6) early studied this group and his information was later supplemented by the work of Lawson. Lawson's Fern Flora of Canada (1889) was used extensively in the common schools of the Province.

Two ecological works published during this period may also be mentioned as they add to the distributional knowledge of the plants. These were the only attempts to study the vegetation instead of the individual species, and were based on the successful concepts developed by Cowles in his study of the vegetation about Lake Michigan. Ganong (1903) discussed in detail the vegetation about the head of the Bay of Fundy, the ecological factors, and the various plant associations of the salt and dyked marshes to be found in that region. Transeau (1909) made a study of the littoral vegetation of the rocky coast at the southern end of the Province.

By 1907 the plants of Nova Scotia as a whole were still imperfectly known, and the enthusiasm of the earlier workers had largely died down. To be sure, the repeated visits of the Dominion Botanist, John Macoun, to the Province had resulted in extensive collections being made of the plants of the northern and eastern parts of the province, but the flora of the southwestern counties was almost entirely unknown. Little collecting had been done between Halifax and northern Cape Breton and

many other counties were represented by only occasional specimens. Plants now known to be dominant or common over much of the western area of the Province were discarded or believed to be rare. The grasses and sedges especially were very imperfectly known.

The second period in this history includes the forty years following the publication of the seventh edition of Gray's Manual in 1907. During this period the plants of the Province were studied mostly by outside workers and few additions were made to the local herbaria. Several publications gave a much more comprehensive picture of the flora and vegetation, and laid a firm foundation for future work. Fernow, Howe and White (1912) were called in to study the forest conditions of the Province. The vegetation of northern Cape Breton was studied in detail by Nichols (1918) and this resulted in an important ecological study of this area in northeastern North America, as well as an increased knowledge of the flora in general. St. John (1921) studied the flora of Sable Island, and reviewed the earlier collections made by Macoun and Gussow; the reports of Fernald (1921, 1922) are indispensable to anyone studying our plants. The study of the estuarine plants by Fassett (1928), although it does not deal in much detail with the plants of Nova Scotia, gives us a further background to our knowledge of plant distribution. Perry (1931) described the vascular flora of St. Paul Island, and the studies of Weatherby (1942) have enlarged our knowledge of a little-known region in central Queens County.

During this period the plants of northeastern North America in general were intensively studied and the taxonomy revised. Much of this work was carried out by Fernald and his students at the Gray Herbarium of Harvard University. The geographical setting of the flora and its relation to that of other regions is given by Fernald (1918, 1921). The distribution of many of the northern plants and their bearing on the problem of glaciation has been discussed by Fernald (1925).

The earlier collections of Nova Scotian plants are mainly in the Provincial Museum at Halifax including those of How from Windsor between 1862 and 1866, Ball from Springhill, Westville, Mahone Bay and other localities, and the Lindsay collections mainly between 1869 and 1873. The Museum has also a duplicate set of the plants collected by C. D. Howe and W. F. Lang in Nova Scotia and Newfoundland during the summer of 1901.

A historic collection exists at the Gray Herbarium of Harvard University. This is composed of the extensive collections made by the Gray Herbarium Expedition to the Province in 1920 and 1921. It also includes duplicate sets of collections made by Howe and Lang, by Fowler at Canso in 1901, by C. A. Hamilton at Boylston, Guysborough County in the 1890's, and many of the collections of Macoun. St. John collected in Pictou County and on Sable Island in 1913. Many of Nichols' collections from northern Cape Breton, obtained mainly during the

summers of 1914 and 1915, are here, as are also J. G. Jack's collections of woody plants made in the Province in 1924. Other more limited collections were made by botanists on shorter visits.

While the Gray Herbarium is especially rich in the plants of southwestern Nova Scotia, the National Herbarium at Ottawa has a good representation of the plants of the eastern region. These are mainly the collections of Macoun, but comprise also the plants collected by Rousseau in eastern Halifax County and Guysborough. Duplicates of many plants of the Gray Herbarium Expedition are found here, so that in general there is a good representation of the plants of this Province. The weed flora is best represented by the many collections made by Groh and Adams in the herbarium of the Plant Research Institute at the Central Experimental Farm, Ottawa. A set of the estuarine plants of northeastern North America collected by Fassett and the herbarium of Dr. G. U. Hay of New Brunswick are found at Acadia University.

The first edition of the "Flora of Nova Scotia" by Roland was published in 1947. This summarized the information scattered in numerous publications, brought up to date the taxonomy of our plants and gave some idea of the distribution of the plants in the Province. The eighth edition of Gray's Manual of Botany appeared in 1950 (Fernald, 1950); and the New Illustrated Flora of Britton and Brown in 1952 (Gleason, 1952). These books stimulated interest in the flora of the region and gave a modern review of the plants involved along with a more accurate means of identification.

The plants and the vegetation of Nova Scotia have been intensively studied since 1947 and particular attention has been given to northern Cape Breton. Numerous species new to the Province have been discovered and the ranges of all the plants have been further detailed. A large herbarium of the plants of Nova Scotia and adjacent areas has been built up at Acadia University so that for the first time ample specimens of our local plants are available for records and study. In addition the Nova Scotia Museum of Science has accumulated a large and representative collection.

The acknowledgements made in the introduction to Part I of this Flora also apply to this section. Reference is made again to the field and collecting work carried out by summer field parties in forest ecology, sponsored by the Nova Scotia Research Foundation. In addition, assistance has been given by the National Research Council of Canada in completing this work and allowing further study. Among our local botanists mention should be made of Mr. J. F. Donley, who collected and studied the orchids of Nova Scotia and also made many interesting collections of other plants in Queens County. Mr. J. S. Erskine collected a number of seasons for the Nova Scotia Museum of Natural Science and visited and described the flora of a number of areas, including the Tusket Islands in Yarmouth County, Sable Island, and St. Paul Island.

Numerous other records from the surrounding areas are shown upon the distributional maps, in addition to those of the Nova Scotian collections. Thus, collections made by Fernald, Bartram, Long and St. John in Prince Edward Island in 1912, and by Macoun in 1888, give a representative sample of the flora of that province; and a more complete record is that of D. S. Erskine (1960). Collections by Fernald, Long and St. John, supplemented later by those of Marie Victorin and others of the Botanical Institute of the University of Montreal, exist for the Magdalen Islands. F. T. Hubbard made extensive collections at Shediac Cape, N. B., during the summer of 1914; C. A. and Una Weatherby repeatedly visited the island of Grand Manan and compiled information on its plants; S. F. Blake collected on the Gulf of St. Lawrence coast of New Brunswick; and A. R. Hodgdon and R. Pike have many records for the Wolf Islands in southern New Brunswick. No particular attempt, however, has been made to get other than published records for such areas.

THE FLORA OF THE REGION

The trees, shrubs and herbaceous plants that compose our flora have a long history. Although the present composition is a very recent development, the individual genera and species are often very old. According to the continental drift theory the continents of North America, Europe and Africa were adjacent to each other in early Tertiary times, fifty million years or more ago, and formed a large continental land mass in the northern hemisphere which is called Laurasia. This land mass was possibly thirty to forty degrees further south than its divisions are today. The middle part of this area is therefore presumed to have been subtropical but, further north, covering most of what is now northern Canada and extending east through Europe to eastern Asia, was a cool temperate or mixed mesophytic forest. Fossil deposits of this flora occur in Spitzbergen, Greenland, Alaska, and across Siberia. The Greenland fossil flora, for example, contains nearly 300 species, including many of our genera of trees and shrubs, 5 species of maple and 15 species of oak.

During the Tertiary period the land mass of Laurasia drifted northward and a rift slowly developed to form the Atlantic Ocean and separate America from Europe and Africa. As the climate became cooler, the rich deciduous forests migrated southward along both sides of the new continents to eastern and western North America, to Europe and to eastern Asia. The hardier plants left behind form our present-day boreal and arctic floras; and south of the Arctic the coniferous trees may have been able to expand their territories and form the nucleus of the vast evergreen forests that developed later. There was undoubtedly a climatic zonation from south to north as it exists today so that plants with a more northern distribution would still have a continuous range

around the northern hemisphere long after the deciduous forests which moved south were divided into separate populations.

Most species of plants are relatively stable and change very slowly. Many of the plants found as fossils for the middle Tertiary, some 50 million years ago, can be classified in the genera of today. Most of the ones found at the end of the Tertiary, over a million years ago, can be recognized as belonging to modern species. The plants changed very slowly, with perhaps a million years being required for the micro-evolution of a new one to occur; and even after a period of ten million years not all the plants of two separated areas may diverge enough to be recognized as separate species.

When the plants of the north temperate zone are examined the species of eastern North America show the greatest change from those of western Europe, an indication of a longer separation between them. The rift separating North and South America from Europe and Africa gradually extended northward until Europe and North America were virtually separated and only island stepping-stones such as Iceland and Greenland provided any pathway between them. The deciduous areas of these two continents have been separated since some time in the early Tertiary and now not a single tree species is common to the two areas. The isolated populations over a long period of time evolved into a number of pairs of species which still resemble each other: *Acer saccharum* and *A. plantanoides*, *Sorbus americana* and *S. Aucuparia*, *Pinus Banksiana* and *P. sylvestris*, *Viburnum trilobum* and *V. Opulus*, along with such herbaceous species as *Polypodium virginianum* and *P. vulgare*, *Oxalis montana* and *O. Acetosella*. Some common American plants still persist as relics in scattered areas in the British Isles, as for example *Eriocaulon septangulare* in western Ireland and western Scotland. An even earlier disjunct population is shown by *Corema Conradii* which has but one related species which grows in Spain, Portugal, the Canary Islands and the Azores.

The flora of the deciduous forests of the eastern United States shows a much closer relationship to that of eastern Asia, since until some time late in the Tertiary the climate may have been mild enough to allow a belt of deciduous forest to stretch continuously from the eastern United States, across Canada to Alaska, and down eastern Asia. The genus *Epigaea*, (trailing arbutus) for example, has but two known species; one is in eastern North America, and one in eastern Asia. The genus *Hydrangea* is found in eastern North America and in Asia; *Clintonia*, on the other hand, has one species in our area, two in western North America and two in eastern Asia. Our blue cohosh, *Caulophyllum thalictroides*, is a species which is common to the eastern side of both continents. A number of our eastern North American species show characteristics found in related plants growing in Japan and Kamchatka.

The plants which have their habitats further north do not show such disjunct ranges but tend to be distributed generally around the boreal zone of the northern hemisphere. Sometimes no difference can be discerned between the plants of Europe, Asia and America. In many cases the American plants were described as separate species but as further work is done in the northern areas the tendency is to classify the American, Asian and European plants as three subspecies or even as three varieties of the same species.

By the close of the Tertiary, a million years ago, our forests probably had a more deciduous nature than they have now and our present species were fairly well defined. There were undoubtedly differences in composition due to altitude and latitude but there is no evidence to indicate any wide band of coniferous trees in the region where the boreal or northern evergreen forest occurs today. Some of our evergreen trees were undoubtedly present further north and probably also along the coast; others were found in alpine areas or on the mountains to the south as they are today, but the development of a widespread evergreen forest is considered to be a recent development in the history of our vegetation.

The most significant event influencing the plants and their distribution in this area is the series of glaciations during the Pleistocene period. The climate became cooler during the Pliocene age, which marks the end of the Tertiary period about one million years ago. During the succeeding period all of eastern Canada and part of the northern United States were repeatedly covered by ice. Four main glaciations are indicated, with warm interglacial periods between them. The ice overran the continent as far south as Kansas, Illinois, and even into northern Kentucky. The last glaciation was the Wisconsin glaciation during which Nova Scotia appears to have been completely covered by ice. The glacier crossed over the Province from a northwestern direction and out into the Atlantic Ocean on to the coastal plain to the vicinity of Sable Island; and further south it extended as far as Cape Cod and northern Pennsylvania.

As the ice became thicker and more water was held in the great continental glaciers, the sea-level became lowered and exposed the outer edge of the coastal plain from Newfoundland southward. Freshwater peats have been dredged up in many places, especially off the coast of New England, and their age determined by radioactive-carbon dating. Data from this and other sources suggest that the sea-level was as low as -123 meters about 19,000 years ago and that it was still 30-40 meters below its present level 8-9,000 years ago. The coastal shelves thus became seaward extensions of the present land areas and extended beyond the limits of Wisconsin glaciation.

The final withdrawal of the ice occurred rather recently and the post-glacial history of Nova Scotia extends back only ten to fifteen thousand years. It is to be expected that the ice may have disappeared

from southwestern Nova Scotia first and withdrawn northwestward towards Cape Breton. There is some evidence that local advances occurred in Cape Breton 10,700 years ago and perhaps at the same time from the South Mountain northward across the Annapolis Valley. The camps of the first hunters of Caribou, found near Truro, have been dated at around 10,000 years ago. At this time the ice had disappeared, or nearly so, from most of Cape Breton except possibly in parts of the plateau. The indications are that the sea-level at this time was still some 40 meters below its present level so that some of the coastal-plain would still be above water and the present area of Nova Scotia, being further from the open ocean, may have had a more continental climate.

Towards the Bay of Fundy and northward the land was lowered by the weight of the ice. Raised beach-lines occur from Digby County north and the Isthmus of Chignecto was partly submerged. Recovery apparently was fairly rapid once the ice retreated so that in the area around the Minas Basin and in Cumberland Bay a band along the coast was covered by trees, including white pine and oak. A wider, more-elevated connection then existed between Nova Scotia and New Brunswick as a migration route for plants. These trees were later submerged by the rising sea-level, as the glaciers further retreated, to form the sunken forests at various places around this part of the coast; and the deposits of silt laid down to form the tidal marshes about the head of the Bay of Fundy covered them. Stumps of this buried forest are now exposed where the marshes have eroded away due to the changing coast line and they appear on a sandy soil when the tide is low.

The expansion of the northern coniferous forests may have occurred during the interglacial stages of the Pleistocene. Trees must have repeatedly migrated back and forth as the ice advanced and retreated. Some would be better adapted to spread and survive on the glaciated poorly-drained soils left after each glacial retreat. The exposed soils would be raw and devoid of organic matter; clays and rock flour would make the soil texture heavy and drainage poor; and the surface drainage systems would be disturbed so that innumerable swamps, pools, lakes and ponds existed. Soils in the northern regions would be frozen to some depth for a considerable time so that species with a shallow root-system would be able to become established more quickly than most of the deciduous species.

There is no reason to think that the vegetation just before the last glaciation was substantially different from that existing at the present time. The climate may have been more temperate at times but from the fossil record in Ontario there appears to have been such species as *Acer spicatum*, *Taxus canadensis*, *Thuja*, *Picea* and *Larix*, all species common at the present time. One result of the repeated glaciations may have been the progressive loss of many of the less adaptable species and the loss of considerable genetic variation in others. On the other hand,

various species which were pushed southward and then expanded northward again still retain evidence of having crossed with more southern species and acquiring some of their characteristics. *Fagus grandifolia*, beech, shows evidence of being derived from two separate species; *Acer saccharum*, sugar maple, shows some of the characteristics of *A. nigrum;* and the variety *phanerolepis* of the balsam fir indicates introgression with the southern *Abies Fraseri* of the Appalachians.

The last glaciation eradicated the plants so far as our present land areas of the Maritime Provinces are concerned, as it is now believed that the entire area was covered by ice. All the plants found in our present vegetation must have migrated into Nova Scotia after the ice receded. The advance of the ice may have been relatively rapid and it is doubtful if northern plants retreated too far south in advance of the ice sheet. There appears to have been no broad tundra belt south of the ice as it advanced although Pleistocene records do indicate that northern trees did range far south and pockets in the south probably expanded their area. The exposed coastal plain would offer a better escape route outward and southward since here the plants would be colonizing bare soil instead of competing with an already established closed vegetation.

As the ice receded from Nova Scotia, around 10,000 years ago, the plants migrated inland and northward onto the newly-exposed land areas. Data from pollen analyses of peat bogs suggest that tundra and steppe conditions prevailed for a considerable time, perhaps a thousand years or more. Grasses, sedges and pteridophytes became common. The trees gradually increased in abundance, probably poplars and aspens first, then birches, fir, spruce and pines. The Alleghenian species such as sugar maple, elm, beech and oak would follow with their typical herbaceous flora. The climate has fluctuated but apparently it has not changed drastically since the first trees appeared. There was probably a period when the climate was warmer and drier, with more oak and perhaps hickory in the eastern regions. A thousand years ago it may have been cooler and moister.

The individual species differ in their genetic variation and their ecological requirements. Thus they would move in at different rates and occupy different habitats. Some would rapidly colonize the exposed territories and be later crowded out as soil and climatic conditions changed or other plants began to compete with them, leaving only relic colonies behind. Heath plants would become common as the soils became leached and more acid. In general the plants would distribute themselves according to the ecological conditions to which they were best adapted. Plants of richer habitats may possibly be still moving into the Province as the deciduous forests become longer established and conditions become more suitable for them to develop.

Botanically, much of Nova Scotia now lies within the hemlock - white pine - northern hardwood region of eastern North America

(Nichols, 1935). The dominant trees are the hemlock, sugar maple, beech, yellow birch, white and red pine, white ash, red and white spruce, balsam fir and red maple. Sugar maple is found on the better well-drained soils, beech on the drier ridges, and hemlock and yellow birch mixed with spruce on lower ground and on more poorly-drained soils. Sandy soils formerly supported good stands of pine. Red maple is found in swampy areas or near lake borders and is characteristic of southwestern Nova Scotia while larch and black spruce predominate in bogs and swamps. In general, the better hardwoods are more common in the northern half of the Province, while the spruces, fir and red maple are dominant in the southern and eastern regions. Basswood, silver maple and butternut have never penetrated into Nova Scotia, although they are found in central and southern New Brunswick. Red ash and white cedar are very local; jack pine is found only on the poorest soils and originally in small amounts. See map C (1-7).

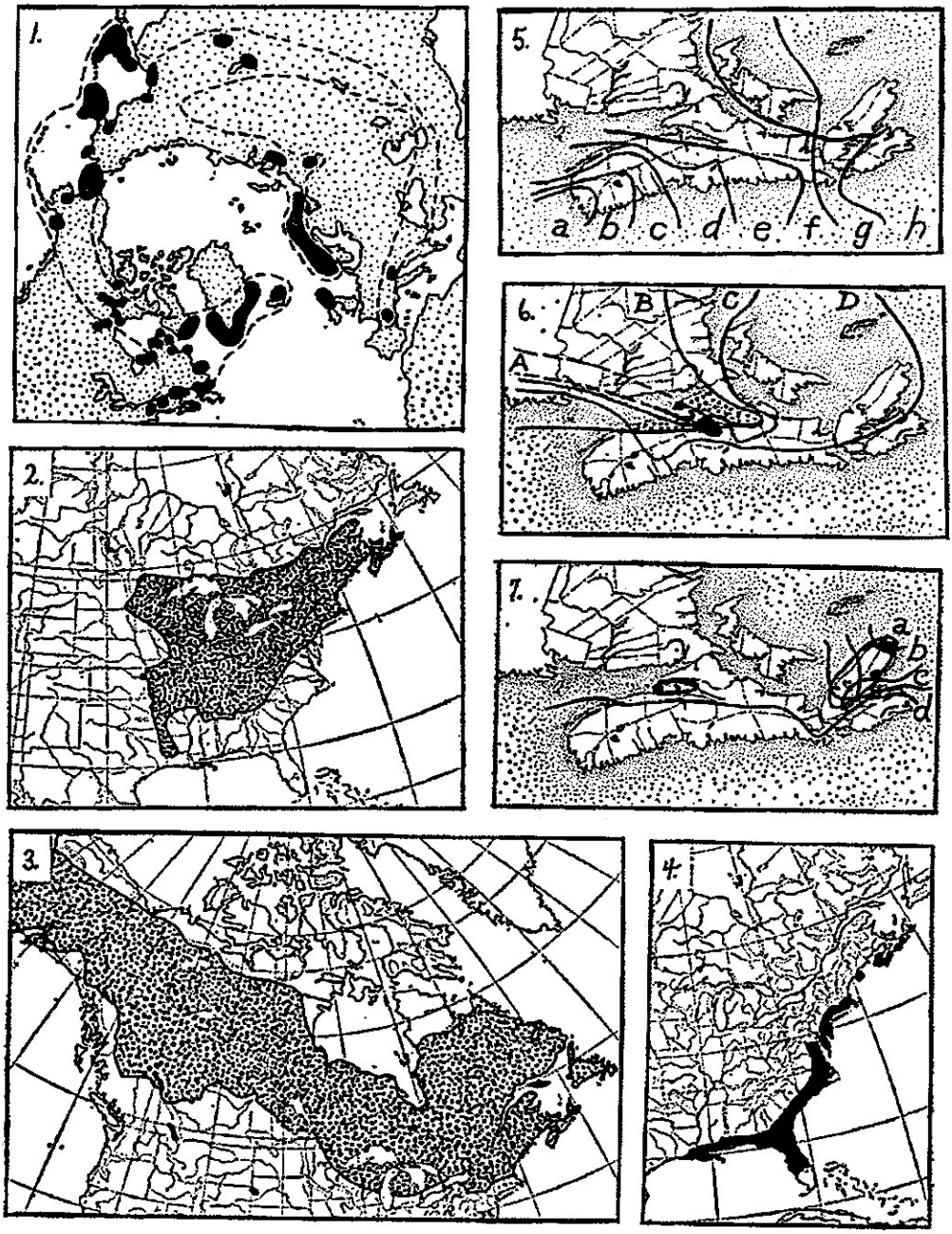
Eastward toward Cape Breton, and to some extent along the Bay of Fundy, white birch, fir and mountain ash increase in amount. Yellow birch does not occur on the plateau of northern Cape Breton above an elevation of 1000-1100 feet. The top of the plateau is covered with a boreal fir forest where the dominant species is balsam fir, mixed with white birch.

The plants of Nova Scotia may be divided into a number of groups called floral elements, with each floral element composed of those plants which have more or less the same distribution outside the area and therefore somewhat the same phytogeographic history. All of our floral elements may be considered extraneous as they have migrated into the area from outside the Province, although their earlier evolution undoubtedly occurred in a northern climate before glaciation occurred.

The main centers from which plants radiated into the newly-exposed areas are those immediately outside of the glacial front, either from reservoirs of plants south of the terminal limits of the ice advance, from plants pushed southward by the advancing glaciers, or from the exposed areas on the outer limits of the coastal plain.

The first plants which established themselves northward on the newly-exposed moraines and glacial debris may have been similar to the more northern plants of bogs and barrens. Rapidly-spreading annuals and perennials such as grasses, sedges, low shrubs and pteridophytes, may have created an open vegetation. Many of these retreated northward as the climate improved. Others diminished in numbers and area as later plants competed with them. These exist now only in bogs and barrens or as isolated relic-colonies on cliff-faces and talus slopes or in isolated valleys and ravines. These arctic and alpine disjunct species may be called the *Arctic-alpine element*.

The northern element, now mainly the plants of the northern evergreen forest which probably first followed the retreating ice northward,



Map C—1. Phyllodoce caerulea, circumboreal range of a relic species in N. S. (after Hulten and Cody). 2. Acer saccharum. 3. Picea glauca, a tree with a boreal range. 4. *Ilex glabra*, a coastal-plane plant (after Fernald). 5. Panicum, northeastern limits, (a) *P. dichotomiflorum*, (b) *P. longifolium*, (c) *P. virgatum*, (d) *P. spretum*, (e) *P. clandestinum*, (f) *P. subvillosum*, (g) *P. lanuginosum*, (h) *P. boreale*, all common in southwestern N. S. 6. Alleghenian species in N. S., (a) Festuca obtusa, (b) Trillium erectum, (c) Erythronium americanum, (d) Trillium cernum. 7. Northern species, the greatest concentration within the two circles, (a) numerous species, (b) Polystichum Lonchitis, (c) Dryopteris Filix-mas, (d) Polystichum Braunii.

is called the *Boreal element*. The range of these plants is from Nova Scotia and Newfoundland to Alaska and often Siberia or throughout northern Eurasia. Closely following and becoming the common plants from Newfoundland and Nova Scotia to Manitoba southward is an element confined to eastern North America which we will call the *Canadian element*, although the larger part of the present ranges of most of these plants will be further south. The plants associated with the hardwoods, sugar maple and beech in our area, which have migrated northward from the rich Appalachian forests is called the *Alleghenian element*, although here again this is merely a reduced northward extension. The true *Coastal-plain element* consists of plants which are common on the coastal plain further south and which moved northward on the exposed coastal plain during glacial times. The *Weed element* consists of plants introduced by man and now common in cultivated areas and elsewhere, mainly introduced from Europe and western Asia, or coming indirectly by way of western Canada in grains and feeds.

Each of these floral elements may be further subdivided as their history is followed further into the past. One of the most interesting groups consists of those plants which are found in eastern North America and then on the islands off western Europe or in relic areas in the northeastern part of that continent. A few plants belonging to this amphi-Atlantic element are mentioned in connection with our coastal plants.

ARCTIC-ALPINE AND BOREAL DISJUNCT ELEMENTS

The first plants which might be expected to migrate into this area under the cool climatic conditions following glaciation are those which show the most northern distribution at the present time. The distribution of arctic-alpine and boreal disjunct species in Nova Scotia has been summarized by Hounsell and Smith (1966). They list 58 species which show a disjunct or scattered distribution in our area, to which may be added three more found on St. Paul Island. The fact that these plants show such a scattered distribution, often being known from but a single or a few locations in our area, and that a number sometimes grow together in a suitable location, suggests that they are relic elements of a flora that was widespread immediately following glaciation and which is now represented better further north in Gaspé, Newfoundland and northern Quebec.

The centers from which these plants spread into our area following glaciation is difficult to determine. The presence of many of them on the higher mountains in New England and northern New York indicates that they were present further south and moved northward following the retreat of the ice. On the other hand their present distribution in eastern North America is almost entirely north of the glacier's southern boundary, which suggests that they were either more abundant southward

before glaciation or else must have moved south as the climate became more severe and their former areas were overrun by ice. One would expect our northern flora to be reduced in number of species during the successive glaciations, with the surviving ones as those best able to migrate.

There is also the possibility that some of these plants survived on the exposed coastal plain, as the presence of a few along the Atlantic coasts now suggest. They would be free to move east or west along the terminal moraines as the ice retreated. It seems dubious that any late migration occurred from the far north or the northwest, both on account of the distance involved and the warm post-glacial period; in many cases our plants do differ from the more northern plants and are described as separate varieties.

In any case these surviving plants may have found conditions suitable for a rapid expansion in the early stages of colonization. Soil and climatic conditions following the last glaciation were quite different from those existing in this area at the present time. The soils would be more alkaline before extensive leaching took place; competition would be less on the large newly-exposed areas; and the climate may have been more severe than at the present time. Groups of northern plants, sedges, grasses, pteridophytes and many herbaceous plants may have become abundant over a wide area, spreading somewhat as many of our weedy species do today and occupying the various habitats as they became available. *Artemisia*, for example, is now very rare and exists here only as a relic species but Livingstone and Estes (1967) found its pollen abundantly represented in the lower part of a profile in a lake on the plateau of Cape Breton.

Their present distribution suggests that these plants were migrating through this area rather than permanently colonizing it. They may have become abundant in the earlier stages. Then, as the climate became warmer, the soils more acid and competition developed from a more vigorous vegetation, these plants survived only in the locations most favorable to them. Some retreated to the north or survived only in cool areas or on headlands around the coast; a few are known only from the top of the Cape Breton plateau or around its edges. A small number of our rarer plants are now found only in deep ravines or on shaded cliffs along the rivers in northern Cape Breton, where they tend to grow in a few restricted locations.

Two or more floral elements may be mentioned, although the individual species are not classified here. The plants which are found on the mountains further south in New England and northern New York are alpine or arctic-alpine plants while those known from only further north are northern boreal, subarctic or arctic. Many of these plants have a circumpolar distribution and are found throughout northern Eurasia, or occasionally persisting only as relic species in Europe.

Three are known only from about the Gulf of St. Lawrence and adjacent areas, of which *Primula laurentiana* is a good example. *Oxytropis johannensis* exists in a number of scattered locations to James Bay; and *Astragalus Robbinsii* seems related to the plants at the type area in Vermont. Such plants have barely survived the rigorous competition and they still have a very tenuous hold on existence. A somewhat similar example is *Pedicularis palustris* which may have survived on the coastal plain and now is known only from southeastern Newfoundland, the Magdalen Islands and eastern Quebec, and from around Cape North and in eastern Guysborough County in Nova Scotia.

The distribution of these plants in the Province varies, with the largest number found in the cooler or more northern regions. Several are found at sea-level around the coast and the six following ones are all found on Brier Island. *Sedum Rosea* and *Claytonia fontana* are rare on rocks on the Atlantic shore, while *Lycopodium Selago* has only been found on Brier Island in this habitat, although both it and the *Sedum* are common on cliffs northward. *Betula Michauxii* is found in coastal bogs in Guysborough Co. and on Brier Island; and *Geum Peckii*, an alpine species of the White Mountains, is found in abundance in the large bog on the same island. *Selaginella Selaginoides* and *Schizaea pusilla* are also found in the bogs near sea-level, and at over 1000 feet altitude on the plateau of Cape Breton.

A few of the plants are widespread in Nova Scotia. *Woodsia ilvensis* is found on cliffs or talus slopes in many locations in the central and northern parts of the Province, becoming more common northward; and *Dryopteris fragrans* is rather typical of rock faces along the Cobequids and has been reported from the Strait of Canso area. In general, however, the most suitable habitats for the survival of these plants seems to be about the head of the Bay of Fundy and on the cliffs, ravines, headlands and high bogs of northern Cape Breton.

Over 20 species are found in the Bay of Fundy-Cobequid area, of which only one variety is not also found in northern Cape Breton. Several are found on the cliffs and on the outer wall of Cape Blomidon; and Schofield, (1955) found a number, including *Saxifraga Aizoon*, *Astragalus Robbinsii*, *Oxytropis johannensis*, *Sedum Rosea* and *Trisetum spicatum*, on the wind-swept crest of Cape d'Or on the Cumberland shore. Others are scattered along the cliffs or near streams on the south side of the Cobequid Mountains in Cumberland and eastern Colchester Counties, where they are found in the lower parts of the valleys and not on the older rocks at higher altitudes. The following are examples of this group.

Lycopodium Selago
Woodsia ilvensis
Woodsia glabella
Asplenium Trichomanes
Schizachne purpurascens
Carex capillaris
Carex atratiformis
Luzula parviflora

Asplenium viride
Dryopteris fragrans
Poa glaucantha
Draba hirta
Arabis hirsuta
Arabis Drummondii

These and additional species occur in the highlands of northern Cape Breton Island where they occupy suitable niches, usually along moist, steep-walled river gorges in Inverness and Victoria Counties or less frequently in more southern parts of the Island. Three species are plants of the high barrens and bogs: *Betula glandulosa*, *Betula borealis* and *Vaccinium uliginosum*. The region between this center of distribution and the Bay of Fundy-Cobequid area, about 170 miles in a straight line, has less suitable habitats and is apparently devoid of these species. The following are further examples of this group which are relatively rare, often known from but a single location and found in Nova Scotia only in northern Cape Breton.

Woodsia alpina
Cryptogramma Stelleri
Poa alpina
Festuca prolifera
Phleum alpinum
Carex scirpoidea
Juncus trifidus
Luzula spicata
Tofieldia glutinosa
Salix cordifolia
Silene acaulis
Saxifraga aizoides
Parnassia parviflora
Phyllodoce caerulea
Diapensia lapponica
Vaccinium ovalifolium
Pinguicula vulgaris
Artemisia canadensis
Arnica chionopappa
Solidago multiradiata

Another group of plants is mainly restricted to northern Cape Breton, or at least its members are much more common there. These plants are found in wooded ravines or damp, cool, deciduous and mixed woods and seem to be more characteristic of what may formerly have been boreal deciduous woods rather than one of a coniferous type. Their distribution is circumboreal but often quite disjunct. In North America they may occur from Newfoundland to scattered locations in New England, New York and southern Quebec, to a limited area around the head of the Great Lakes, and then be common from Alaska to Colorado or California. Most are found in eastern Siberia and many in Eurasia, with two ferns common in the northern part of the British Isles, Iceland and Greenland. In general, these are the plants that give the distinctive character to the cooler deciduous or mixed woods of northern Cape Breton.

This group, or part of it, may be called the *Cordilleran element* of our flora, as these plants are common in a somewhat similar cool moist habitat on the Pacific Coast or along the Rocky Mountains. The lack of suitable areas in central North America for the more southern forms leads to their disjunct distributions, while rather similar plants which are

more northern, may have a more general distribution across the continent. The following plants are found often growing together in northern Cape Breton.

Cystopteris fragilis
Dryopteris Filix-mas
Polystichum Lonchitis
Polystichum Braunii
Luzula parviflora
Goodyera oblongifolia
Epilobium Hornemanni
Osmorhiza chilensis
Galium kamtschaticum

Epilobium Hornemanni is northern and is found in cool ravines towards the top of the plateau. *Cystopteris fragilis* is more general in northern Nova Scotia, but in Cape Breton is also represented by variety *laurentiana*, which is found only about the Gulf of St. Lawrence. *Polystichum Braunii, Luzula* and *Osmorhiza* are also found scattered about the head of the Bay of Fundy in rich woods or in ravines. *Dryopteris Filix-mas* is confined to northern Cape Breton but it is often luxuriant, with plants at the northern end of the Island growing out onto the open roadsides. *Galium kamtschaticum* is rare in eastern Canada and then is found only in northern British Columbia, the Aleutian Islands and in eastern Siberia. *Osmorhiza*, on the other hand, is found from British Columbia to Arizona and reappears again in Chile and Patagonia.

THE BOREAL ELEMENT

The boreal forest stretches from Nova Scotia and Newfoundland to Alaska and is the most extensive forest type in Canada. The present widespread distribution and significance probably developed during Pleistocene time when the repeated advance and withdrawal of the ice led to extensive climatic changes and created wide expanses of poorly-drained soils. While the dominant tree varies, the white spruce, with black spruce, American larch, trembling aspen, balsam poplar and paper birch are all characteristically present. Jack pine and balsam fir are associated species in eastern North America.

The latitudinal width of this forest was undoubtedly much compressed in advance of the various glacial advances. However, the various species probably expanded their areas at higher altitudes further south; fossil records show their Pleistocene distribution as far away as the Gulf States.

The typical plants of this element in Nova Scotia are now associated with the evergreen forest and are found in the coniferous woods and the swamps, swales and bogs associated with it. Because they are relatively northern, their ranges do not show such a broken distribution as those of more southern plants and they often occur around the northern hemisphere. The following list gives a number of the representative plants of

this element, all of which are also found, or have close relatives, in eastern Siberia and often throughout northern Eurasia.

Lycopodium annotinum
Selaginella Selaginoides
Typha latifolia
Scheuchzeria palustris
Alopecurus aequalis
Eriophorum angustifolium
Eriophorum Chamissonis
Carex diandra
Carex disperma
Carex canescens
Calla palustris
Luzula multiflora
Habenaria hyperborea
Smilacina trifolia
Streptopus amplexifolius
Listera cordata
Myrica Gale
Alnus crispa
Nuphar variegatum
Ranunculus Gmelini
Coptis groenlandica
Mitella nuda
Ribes triste
Potentilla palustris
Geum rivale
Rubus pubescens
Viola Selkirkii
Circaea alpina
Hippuris vulgaris
Moneses uniflora
Pyrola secunda
Chamaedaphne calyculata
Vaccinium Oxycoccos
Menyanthes trifoliata
Utricularia intermedia
Galium triflorum
Viburnum edule
Linnaea borealis
Anaphalis margaritacea

Several plants are found in Prince Edward Island and in northern Cape Breton which have not been found on the peninsula of Nova Scotia. *Caltha palustris*, ranging from Newfoundland to Alaska and Eurasia and south to South Carolina and Tennessee, is common through Prince Edward Island but in Nova Scotia is found only in coastal swales along Inverness County from Mabou Harbour north to Pleasant Bay. *Betula pumila* is rare in Prince Edward Island but in Nova Scotia is found only on the plateau of northern Cape Breton. A plant with a somewhat similar distribution is *Sanguisorba canadensis*. This is widespread in eastern North America and separated from a variety from Alaska to British Columbia. It is not found in Prince Edward Island but it is found in northern New Brunswick and in Gaspé and is common in Inverness County in northern Cape Breton. It would appear that these plants were once more common but have now retreated northward and exist only in the most suitable or cooler locations. Several others, such as *Comandra Richardsiana* and *Anemone canadensis*, are found along the coast in eastern Nova Scotia but are very rare.

Plants with a more northern, or Hudsonian range, are found chiefly on headlands or barren areas in the cooler regions. Typical example of this is the bakeapple berry, *Rubus Chamaemorus*, which is found far north around the northern hemisphere. This fruits fairly well around

the coast but is practically sterile inland. The *Euphrasias* are very common on headlands and around the coast but it is difficult to know whether these are native or largely introduced. Other plants which are northern and found in our most exposed habitats are:

Scirpus cespitosus
Juniperus communis
Juniperus horizontalis
Arenaria lateriflora
Empetrum hermaphroditum
Vaccinium Vitis-Idaea
Halenia deflexa

Many of the plants which are most typical of our coniferous woods do not actually belong to this boreal element, even though some of them now extend northward to the Arctic. These plants which are more confined to eastern North America, or have been longer isolated from their Eurasian relatives, are placed in the following element.

THE CANADIAN ELEMENT

The background flora of northeastern North America may be called the Canadian element. These plants are the ones which range from Nova Scotia and Newfoundland to Manitoba, south to Pennsylvania, and in the mountains to North Carolina and Tennessee. Further south they exist at higher altitudes; or they may be common in the earlier stages of succession and on the poorer sites south of the glacial boundaries. There thus existed a reservoir of plants available to recolonize more northern areas as the glaciers receded.

As with each element, species of different ecological amplitudes are present. White pine, hemlock, sugar maple and beech make up much of the mixed northern hardwood forest. The yellow birch and fir extend to the plateau of northern Cape Breton; along the Atlantic coast red maple is mixed with the evergreen forests; red spruce is a common tree; and the large-toothed poplar is found on lighter soils.

The shrub types are likewise widespread. Wire birch occurs on the lighter soils and barely reaches Cape Breton; choke-cherry occurs along the intervales, mountain maple in the cooler regions and along ravines, and lower shrubs, such as false honeysuckle, witherod, hardhack and Canada honeysuckle, are typical. The ericaceous or heath plants are abundant in the earlier stages of succession and are particularly common on the acid soils near the Atlantic coast. Rhodora, lambkill and various blueberries are found throughout.

A large number of our plants show this general distribution in eastern North America and the following list presents a number of the more common ones.

Polypodium virginianum
Dennstaedtia punctilobula
Dryopteris Thelypteris
Rubus canadensis
Impatiens capensis
Viola cucullata

Onoclea sensibilis
Scirpus rubrotinctus
Carex arctata
Carex gynandra
Pontederia cordata
Luzula acuminata
Maianthemum canadense
Streptopus roseus
Clintonia borealis
Trillium undulatum
Habenaria psycodes
Chrysosplenium americanum
Circaea canadensis
Aralis nudicaulis
Hydrocotyle americanum
Epigaea repens
Gaultheria procumbens
Trientialis borealis
Galium palustre
Houstonia caerulea
Mitchella repens
Eupatorium perforatum
Solidago puberula
Aster lateriflorus

Most of these plants are found in open woods, pastures, barrens or old fields throughout the Province. Some are restricted to the richer habitats; a few are found only in the northern part of the area and are rare or absent along the Atlantic coast. Some, *Maianthemum canadense* for example, seem adapted to our coniferous woods; *Chiogenes hispidula* and *Mitchella repens* are also often found on mossy hummocks in this habitat. In general, these plants are the common ones of our flora and thus are the most familiar and unexciting to one looking for rare species.

THE ALLEGHENIAN ELEMENT

The plants that are here included in the Alleghenian floral element are those restricted to rich habitats or our best deciduous woods and which have a distribution mainly far to the south in the deciduous forest. The maximum northern range is usually more restricted than that of the sugar maple, from Nova Scotia to Minnesota south to the Gulf States. In Nova Scotia they are usually found only on the better soils in the northern part of the Province from Annapolis County to Cape Breton in the region of rich woodlands and along the river intervales. Many of the species are among our rarest plants, found in only a few scattered locations from the Annapolis Valley and central Nova Scotia eastward. Some are widespread and general in their habitats and thus approach the plants of the Canadian element. A few are rare or scattered on the intervales of central Nova Scotia and become general only along the rich flood-plains of northern Cape Breton.

They have presumably entered the Province by the narrow neck of land connecting Nova Scotia with New Brunswick when this area was more elevated above the sea than it is at present. The center of their distribution seems to be in the Cobequid Mountains of Cumberland and Colchester Counties or on the intervales about the head of the Minas Basin, from where they have migrated eastward to northern Cape Breton and to a lesser degree westward along the Annapolis Valley and the North and South Mountains bordering it.

The following are examples of plants with this restricted range in the Province and included in this element.

Athyrium thelpyterioides
Adiantum pedatum
Festuca obtusa
Glyceria melicaria
Hystrix patula
Carex torta
Carex plantaginea
Uvularia sessilifolia
Allium tricoccum
Erythronium americanum
Polygonatum pubescens
Trillium erectum
Polygonum arifolium
Ostrya virginiana
Hepatica americana
Caulophyllum thalictroides
Sanguinaria canadensis
Dicentra Cucullaria
Dentaria diphylla
Tiarella cordifolia
Desmodium glutinosum
Sanicula gregaria
Triosteum aurantiacum

None of the above plants has been found on Prince Edward Island. A few plants of this type have crossed the Northumberland Strait. These include *Carex scabrata, Clematis virginiana, Viola eriocarpa, Aralia racemosa* and *Osmorhiza Claytoni.* A few others occur both on Prince Edward Island and in Newfoundland: *Trillium cernuum,* which perhaps belongs more to the Canadian element, *Claytonia caroliniana* and *Ranunculus recurvatus. Impatiens pallida,* on the other hand, is found in Newfoundland but not in Prince Edward Island.

The greatest concentration of this element is along the Cobequid Mountains east to Truro, where a number of them grow in the sugar maple woods or in the valleys between the hills. Some are found also on the top of Cape Blomidon or in the surrounding areas. The greatest concentration is on a small intervale at Kemptown in Colchester County where under relic sugar-maple woods the ground is white with bloodroot in early May, followed later by a mat of wild leek. Yellow violets and spring-beauty are common; Dutchman's breeches, blue cohosh, *Osmorhiza,* and *Sanicula* are also present. *Uvularia* is less common and *Tiarella* is common in the neighborhood. *Lilium canadense* grows along the river.

The Alleghenian element is thus characteristic of sugar-maple woods or richer intervale soils; it is a much reduced sample of the type of vegetation found further south or more inland in the deciduous forests.

THE SOUTHWESTERN FLORA

The southwestern part of the Province exhibits a floristic picture quite different from that of the more northern counties. This region comprises that part of the old Atlantic upland in the southwestern part of the Province, particularly that part of it formed from slates. Roughly this area is that south of a line from Digby Neck east through central

Annapolis and Hants Counties to Musquodoboit Harbour in Halifax County, with parts of eastern Cape Breton showing some similarities in climate and habitat. The plants typical of this region are largely lacking in the quartzite and granitic areas northward and eastward.

It is a region of lakes and barrens, of innumerable pond-holes and sloughs, with rather level topography, high humidity and acid soils. Plants which are absent or rare in the northern regions often grow here in great luxuriance and abundance. At the same time many of the heaths, sedges and bog plants of the more northern range are also common. This intermingling of northern and southern plants is often very conspicuous.

Fernald (1921) commenting upon Merriam's life zones remarks: "In a region where the Louisianian *Lycopodium inundatum*, var. *Bigelovii* (*L. adpressum*) and the Louisianian and Carolinian *Utricularia subulata* creep among the bases of *Carex Goodenowii* (Greenland and arctic America, south to Nova Scotia and eastern Massachusetts) or of *Juncus filiformis* (Greenland to Massachusetts and the mountains of Pennsylvania); where the Louisianian and Carolinian *Eleocharis tuberculosa* vies with *Carex oligosperma* (Labrador to Great Bear Lake, etc.) for the possession of the edge of a savannah; when the dominant undergrowth in the spruce, fir and larch swamps includes the Louisianian and Carolinian inkberry, and such a distinctly southern plant as *Solidago Elliottii;* inkberry makes tall thickets with *Ledum groenlandicum* or pushes its branches through the carpet of arctic crowberry, *Empetrum nigrum*, or the arctic cloudberry or bakeapple (*Rubus Chamaemorus*); in a region where these comminglings are met at every turn, one is certainly perplexed to make Merriam's zones fit the facts."

The general impression of the flora of this region, at least near the coast, is quite different from that of the more inland and northern regions. Red maple is a common and characteristic deciduous tree. The bayberry is one of the most common shrubs; highbush blueberries are common; inkberry may be expected in a variety of habitats; and there is a multitude of forms of *Rubus*. Various species of *Sisyrinchium* are abundant in the ditches; *Gerardia* is found on any moist ground, with the delicate grass *Sporobolus uniflorus* and various *Panicums* ubiquitous. The conspicuous weedy species are *Holcus lanatus*, velvet grass, and the introduced *Alchemilla* or lady's mantle. The conditions favorable for these plants exist near the coast, along the river valleys and around the lakes where high moisture conditions occur and suitable bogs, pools, rills and strand-lines are found.

The plants of the southwestern flora are believed to have persisted during the last glaciation in a refugium off the Atlantic Coast or to have moved northward over the exposed coastal plain during the time when the glacier was retreating. The glaciation at its maximum extended to Sable Island, which marks the terminal moraine, south to and along

Cape Cod and Long Island inland across Pennsylvania. Outside and south of this limit the coastal plain was exposed due to the lowering of the ocean level to as much as 65-70 meters. Recent investigations have revealed the presence of layers of fresh-water peat, teeth of mammoths and other evidence of plant and animal life during the last glacial period.

The vegetation on this exposed coastal plain may have presented a mixture of plants such as we find today in southwestern Nova Scotia or further south in Cape Cod and New Jersey. The common coastal plants may have moved outward as the glacier advanced; the exposed land with its ponds, sandy or peaty soils and stream edges would present a suitable area for colonization by more southern plants; while in exposed locations the more northern plants pushed southward or outward could persist. As the glacier retreated and the sea-level rose, these plants again moved back or, in the case of more southern plants, extended their range northward to southwestern Nova Scotia and finally became isolated from their ranges further south as they are absent from Massachusetts, along the coast of Maine and New Brunswick and around northern Nova Scotia.

Members of different floral elements moved into southwestern Nova Scotia because, presumably, there was a varied vegetation on the exposed coastal plain. Plants of the Canadian element may have moved into the southwestern area first and only later invaded northern Nova Scotia as they migrated up through Maine and New Brunswick. Plants of the strictly *Coastal-plain element* are those confined almost entirely to the plain further south, or with minor extensions inward along the rivers and lakes. The following are members of this element now found from Florida to Louisiana or Texas and some to Mexico or the West Indies, and north along the coast to eastern New Jersey, to New England, or then jumping to southwestern Nova Scotia.

Lycopodium inundatum Bigelovii *Xyris caroliniana*
Woodwardia areolata *Smilax rotundifolia*
Potamogeton pulcher *Sisyrinchium atlanticum*
Panicum dichotomiflorum *Habenaria flava*
Panicum spretum *Polygonum hydropiperoides*
Panicum longifolium *Polygonum punctatum majus*
Carex Howei *Ilex glabra*
Carex atlantica *Proserpinaca pectinatus*
Eleocharis tuberculosa *Hydrocotyle umbellata*
Rhynchospora capitellata *Bartonia virginica*
Juncus marginatus *Utricularia radiata*
Lachnanthes tinctoria *Utricularia subulata*

Others are confined to the northern part of the coastal plain. They show the same disjunct range but in the United States range southward only to Cape Cod, to the New Jersey pine barrens, or to Virginia.

Dryopteris simulata
Glyceria obtusa
Lophiola aurea
Myriophyllum humile
Coreopsis rosea
Sabatia Kennedyana
Polygonum puritanorum
Solidago Elliotii
Solidago galetorum

These plants often exhibit a relationship to tropical genera or families, which might be expected for plants which range so far south. Many of them may have originated long ago in the eastern part of the United States when the climate was warmer, and moved out onto the newly-exposed coastal plain when the land rose in late Tertiary time a few million years ago. Others, such as variety *majus* of *Polygonum punctatum* and a number of our coastal plants, may have originated in South or Central America and then moved later gradually northward along the coastal plain.

Other plants which are distinctly coastal-plain in nature but which have developed a wider distribution are very common in southwestern Nova Scotia and occur also inland and in Cape Breton, and often also in southern or southwestern Newfoundland.

Juncus militaris
Xyris montana
Calopogon pulchellus
Habenaria blephariglottis
Myrica pensylvanica
Drosera intermedia
Aronia arbutifolia
Rosa palustris
Hudsonia ericoides
Bartonia paniculata
Gratiola aurea
Rhexia virginica
Viola lanceolata
Gaylussacia dumosa

A few plants have practically moved off the coastal plain entirely but are obviously of this origin since they have their close relatives on the coastal plain or far southward. *Utricularia cornuta* is found from Florida to Texas and in the West Indies but is common in bogs from Newfoundland to Minnesota. *Pogonia ophioglossoides* grows from Florida to Texas and from Newfoundland to Minnesota. Our Nova Scotia variety resembles closely the only other species, found in Japan. *Sarracenia purpurea* is characteristic of bogs in the boreal zone as far west as the Mackenzie. It is common in southwestern Nova Scotia and occurs to New Jersey. Further south it is represented by a variety which grows to Florida and Louisiana; and all the other species of *Sarracenia* are in the southeastern United States. Our most interesting plant of this group is *Schizaea pusilla*, the curly-grass fern. This species is far isolated from the other species in the tropics and the southern hemisphere. It is now found only in local areas in the New Jersey pine barrens, one station on Long Island, and then is common in southwestern Nova Scotia, along the coast to and on the plateau of Cape Breton and in Newfoundland. Its range now seems like a disjunct one of a northern species with the

southern stations being only relics of a formerly more widespread southern distribution.

The vegetation on the now-submerged coastal plain was apparently varied. Therefore many plants with a wider range in the northern States and Central Canada spread into southwestern Nova Scotia but, due to climatic or edaphic factors, they have never migrated along the Maine coast as far north as New Brunswick. Species, such as *Symplocarpus foetidis*, *Decodon verticillatus* and *Cephalanthus occidentalis*, are confined to southwestern Nova Scotia. Their local range is much like that of a coastal-plain element plant, but they have a general range in the United States far to the westward. *Vaccinium corymbosum*, the highbush blueberry, is common in the extreme southwestern Nova Scotia but has a more general range further south. *Cyperus dentatus* is scattered on sandy and gravelly lake shores in southwestern Nova Scotia, but inland it reaches up to southeastern New Brunswick, southern Quebec and Indiana.

Many plants may have migrated into the Province by two routes, by southwestern Nova Scotia over the coastal plain and also southward from New Brunswick, with the southwestern plants differing slightly or sometimes with characteristics of more southern species. For example, Aalders and Hall found that diploid plants of *Rubus* were almost entirely confined to southwestern Nova Scotia while the inland and northern plants were triploid or higher. The varieties of *Juncus effusus* are also quite different, at least in relative abundance, in the two areas. Our common alder in the southwest seems to have characteristics of *Alnus serrulata;* and the sugar maple on Digby Neck has apparently introgressed with *A. nigrum* to a considerable extent.

Sable Island presents a remnant on the coastal plain, formed apparently from material in the terminal moraine. The island is subjected to frequent fogs, wind is always present and variations in temperature are rather less than on the mainland. At high tide it has a length of about 20 miles and a width of up to three-quarters of a mile, consisting mainly of two lines of dunes with a low undulating central valley with ponds of fresh or brackish water and a great salt lake.

The flora has been treated in detail by Harold St. John (1921); and the island has since been visited by J. S. Erskine (1954). In general the flora is an attenuated one consisting of plants capable of existing in open situations, mostly of herbaceous plants with a few low shrubs. About 150 native species and varieties are known, with an additional number of weedy introduced plants.

The flora, as might be expected from the unfavorable habitat, has a rather boreal nature. Many of the coastal plants are present such as *Arenaria lateriflora*, *Potentilla tridentata*, *Empetrum hermaphroditum*, *Mitchella repens* and even *Linnaea borealis* and *Smilacina stellata*. *Juniperus communis* is variety *megistocarpa*, found in western Newfoundland, eastern Nova Scotia and the Magdalen Islands; the *Fragaria*

virginiana is var. *terrae-novae;* and the *Thalictrum polygamum* is the more northern var. *hebecarpum*. Some plants of the ponds, such as *Potentilla palustris, Menyanthes trifoliata* and *Nuphar variegatum*, are also boreal in nature.

The coastal-plain species are those belonging to the more widespreading group such as *Calopogon pulchellus, Myrica pensylvanica, Drosera intermedia, Viola lanceolata, Gerardia neoscotica, Utricularia cornuta*, and *Rosa virginiana*. *Polygonum hydropiperoides* was separated as variety *psilostachyum* by St. John; and Fernald ascribes this also to Shelburne County on the mainland. The one species found on Sable Island and not elsewhere in eastern Canada seems to be *Centunculus minimus*, which elsewhere occurs locally north only to Delaware.

A number of varieties have been described from Sable Island material. A prostrate form of *Juncus pelocarpus*, var. *sabulonensis*, is now also known from southwestern Newfoundland. *Hieracium scabrum* var. *leucocaule* and *Potentilla Anserina* var. *lanata* are forms with woolly stems and are apparently endemic. Variety *latifolius* of *Calopogon pulchellus* and the doubtful variety *retusus* of *Lathyrus palustris* are also reported for St. Pierre and Miquelon or on the Magdalen Islands.

Another indication that the flora of Sable Island may have survived in a refugium on the northern part of the coastal plain is the presence of two species restricted in North America to southwestern Newfoundland and Sable Island. These are *Juncus bulbosus* and *Potamogeton oblongus* and both also occur in western Europe, North Africa and in the Azores.

The evidence in respect to two grasses, *Nardus strictus* and *Sieglingia decumbens*, found on the Avalon Peninsula of Newfoundland and in southwestern Nova Scotia, is more dubious. Neither one has been found on Sable Island. It is tempting to regard these as further examples of European plants native to a corner of North America, but the possibilities of their being recent introductions in Nova Scotia, as is undoubtedly the case with the grasses *Holcus lanatus* and *Molinia caerulea*, is very great.

The true coastal-plain flora does not seem to be spreading further inland and there are indications that to a large extent it too is a relic of a more widespread flora once growing on the now submerged northern coastal plain. Many of these plants probably had a wider distribution when more of the coastal plain was exposed. As the sea-level rose they would survive only in a few favorable locations around the inland fringe of their range. Widely isolated stations may thus occur. The goldencrest, for example, survives only on Digby Neck and Brier Island, along Ponhook Lake in Central Queens County, and at Fancy Lake in Lunenburg County. Many of the plants are known from only along the Tusket River system in Yarmouth County; others may be found along the Clyde River, the area about Barrington, or along the Medway. The ecological conditions are quite different in the southwestern area and even such common genera as *Rubus* and *Panicum* become progressively more restricted further east.

PLANTS OF THE SEASHORE

Some 50 of our plants are restricted to the sea-shore, growing on sandy or gravelly beaches, rocky cliffs or the salt marshes. Many are common around the whole Province and form a typical open vegetation with a limited number of species. These plants often have a wider general distribution than the more inland plants because of the uniformity and continuity of the habitat; they may occur along the seashores for great distances. Further, most of our sea-shore plants are found in western North America on the alkaline soils. A number which are coastal in our area are found around the Great Lakes and elsewhere near fresh water. A few, such as *Zannichellia palustris*, *Phragmites communis* and *Potamogeton pectinatus*, have a distribution that can almost be called cosmopolitan as they occur on several continents. As with the inland flora, these plants have different histories and various present distributions; and they thus may be classified into different floral elements. Three main ones are mentioned here.

A few of these plants have a more southern origin and range and thus comprise the sea-shore section of the coastal-plain flora. These originated far to the south. They are now found in Mexico, the West Indies and sometimes in South America; or they occur along the Gulf of Mexico and extend north to Nova Scotia or beyond. In some cases the northern and southern plants have developed to form separate varieties. Four of these plants reach only to the southwestern tip of Nova Scotia.

Distichlis spicata
Spartina patens
Eleocharis rostellata
Scirpus Olneyi
Euphorbia polygonifolia
Lilaeopsis chinensis
Samolus parviflorus
Limonium Nashii
Gerardia maritima
Solidago sempervirens

The *Distichlis* reaches Prince Edward Island and Cape Breton, while the sea-shore goldenrod is common around the whole coast and reaches southern Newfoundland.

The northern plants are found from Newfoundland to Alaska, on the Pacific Coast, and usually also in Eurasia. They have a circumboreal or circumpolar distribution of wide range, sometimes represented by different varieties in different areas. These plants are representatives of an old coastal flora across northern North America when the climate was presumably warmer. In most cases they are sufficiently hardy now to extend at the present time far to the northward. Their distribution is therefore much like our boreal floral element, extending southward in the interior and along our coast to Nova Scotia, Cape Cod and Virginia. Such a plant as *Spergularia canadensis* now has a disjunct range, occurring only on the northern Atlantic and the northern Pacific coasts. One Asiatic species, *Artemisia Stelleriana*, native from Kamtchatka to Japan,

has escaped from cultivation and rapidly spread along our seacoast from Quebec to Virginia. It is now a common coastal plant around Nova Scotia. In our area these plants extend southward to Cape Cod or Virginia; and many of the most common seaside plants belong in this group.

Elymus mollis
Hierochloe odorata
Scirpus rufus
Carex Mackenziei
Carex salina
Juncus balticus
Juncus Gerardi
Atriplex patula
Salicornia europaea
Suaeda maritima
Spergularia marina
Arenaria peploides
Ranunculus Cymbalaria
Potentilla Anserina
Lathyrus japonicus
Mertensia maritima
Glaux maritima
Plantago maritima
Senecio Pseudo-Arnica

A smaller number of species is found only in eastern North America and in Europe. These are called amphi-Atlantic or North Atlantic species. In general they appear to have a less northern range about the warmer areas of the Gulf of St. Lawrence southward. *Najas* is a freshwater species.

Najas flexilis
Ammophila breviligulata
Puccinellia americana
Agropyron pungens
Carex paleacea
Polygonum Raii
Polygonum oxyspermum
Atriplex sabulosa
Cakile edentula
Ligusticum scothicum

In Europe *Agropyron* and *Polygonum oxyspermum* are mainly plants of the Baltic. *Cakile edentula* seems to be a plant able to spread by salt water and it occurs in such widely scattered locations as the Azores, Iceland and southern Labrador to South Carolina. The *Ammophila* and *Puccinellia* have been separated from closely-related European species, suggesting again that the two floras have been separated for a considerable time. Two freshwater species may also be mentioned. *Potamogeton epihydrus* is found in lakes on the outer Hebrides; and *Eriocaulon septangulare* is found in western Ireland and western Scotland.

There are, in addition, species confined to the eastern coast of North America. *Carex silicea* of the sandy dunes and bars occurs from Newfoundland to Maryland; and *Rumex pallidus* is found from Newfoundland to Long Island. Such species are relatively few in number. As with many of the other more wide-ranging plants, they also often extend inland to the Great Lakes and sometimes to James Bay, to where they have perhaps migrated along old shore-lines following a partial submergence of the land immediately following the last glaciation.

INTRODUCED PLANTS AND WEEDS

The number of introduced plants in the Province is high relative to that of the total flora and over 400 are known, with a number of others belonging to the doubtful list. The common weeds are found throughout; others, such as the mustards and many hawkweeds, are still rapidly spreading. Many of the small plants are found mainly as railroad weeds; and numerous plants of European origin are being repeatedly introduced from western Canada in grains and feeds. Nova Scotia, as it is a coastal province, also has had numerous foreign plants brought in around the ports where they are merely adventive or have become locally established. Some old fashioned garden plants tend to persist for a long time around habitations; others tend to be weedy and spread out, at least temporarily, from the gardens where they are grown.

It is difficult to know whether some plants are introduced or not. The various *Euphrasias* around the coast are often considered introduced; and *Sieglingia decumbens* and *Nardus stricta* in southwestern Nova Scotia are two more dubious native plants. In a number of cases two varieties have been described; one is supposed to be native to North America and the other to be introduced from Europe. *Agropyron repens*, *Prunella vulgaris* and *Veronica officinalis* are examples of this type and it is doubtful if the native and the introduced plants can now be distinguished. The chromosome number in some cases serves to help clarify their history. The introduced *Achillea Millefolium* seems to have a different number from our native plants; while in some cases different introductions have different numbers. For example, Mulligan has pointed out that *Matricaria maritima* introduced into Prince Edward Island has one more chromosome than do the plants of Nova Scotia and New Brunswick.

The role of prehistoric man may also be important in some cases; and there is evidence that he came to the Province soon after it was first free of ice. The erratic distribution of *Crataegus*, in particular, may be due to sporadic introductions. Different types are characteristic of different areas and they are especially common and varied along the Margaree River in northern Cape Breton. To a lesser degree the same seems to be true of *Amelanchier*.

More recent introductions are linked with the French settlement. *Inula Helenium* and *Daphne* are scattered around areas such as Annapolis and Grand Pré. *Molinia caerulea*, *Succisa pratensis* and *Angelica sylvestris* are common about Louisburg; while the tiny *Millegrana Radiola*, first noticed at Louisburg by Macoun, has now spread along the Atlantic coast as far as Brier Island.

Some recent introductions are now a very conspicuous part of our flora. *Holcus lanatus* and *Alchemilla xanthochlora* are very common in southwestern Yarmouth County; the cuckoo flower, *Cardamine pratensis*, is very common in early summer and turns the meadows white in the

Annapolis Valley; and later the same meadows may be pink with *Lychnis Flos-Cuculi*. *Senecio Jacobaea* is everywhere in eastern Nova Scotia.

A few potentially very troublesome weeds are recent introductions or are still rapidly spreading. *Amaranthus retroflexus*, *Portulaca oleracea*, *Cyperus esculentus*, and *Barbarea vulgaris* are a few examples and others undoubtedly will be introduced in the future.

IV. ANGIOSPERMS

FLOWERING PLANTS

CLASS 2. DICOTYLEDONS

The Dicotyledons are the largest group of flowering plants and comprise over 250 families. The leaves are typically net-veined and there is seldom sheathing at the base; the flower-parts are mostly in 4's or 5's; a cambium is usually present so that the wood of the stem increases in thickness; and the embryo of the seed has two seed-leaves or cotyledons.

Four divisions are recognized. The *Amentiferae* include woody forms having some or all of their flowers in catkins, or aments, and without a corolla. The *Floriferae* include the families with apetalous flowers in various other types of inflorescences. The *Polypetalae* have separate petals; while in the *Sympetalae* the petals are more or less united. Occasional genera or species of the last two groups are exceptions and may have the petals absent.

a. Corolla absent; calyx absent, or when present in a single whorl, sometimes quite petal-like.
  b. Shrubs or trees; plants woody at least at the base.
    c. Flowers either pistillate or staminate, one or both types in catkins or catkin-like heads (*Amentiferae*).
      Fertile flowers 1-3, in a cup or involucre; fruit a nut (Fig. 63, a-c): oak and beech. *Fagaceae* p. 340
      Fertile flowers in catkins or catkin-like heads; or, in *Corylus*, from a scaly bud.
        Ovules many; fruit a many-seeded capsule; seeds hairy-tufted (Fig. 59); willow and poplar. *Salicaceae* p. 320
        Ovule one; fruit one-seeded; seeds not hairy-tufted.
          Fertile flowers 2-3 at each scale of the catkin; shrubs or trees; leaves not resinous-dotted beneath (Fig. 61, 62). *Corylaceae* p. 333
          Fertile flowers solitary in the axils of the scales; low shrubs; leaves resinous-dotted beneath and often aromatic (Fig. 60). *Myricaceae* p. 331
    c Flowers not in catkins.
      Shrubs, less than 3 dm high, low or trailing; leaves evergreen, needle-like (Fig. 95, a, b). *Empetraceae* p. 494
      Shrubs to 1 m high or more, or trees.
        Leaves opposite; trees.
          Leaves pinnately compound with 7-11 leaflets, the terminal one not lobed; fruit a one-seeded samara; ash (Fig. 112). *Fraxinus* p. 577
          Leaves palmately lobed or divided, if compound then with the terminal leaflet lobed; fruit of two united winged halves; maples (Fig. 98). *Aceraceae* p. 501
        Leaves alternate.
          Leaves silvery-downy beneath and scurfy; fruit a yellowish berry; flowering in early May; shrubs (Fig. 97, f). *Shepherdia* p. 524
          Leaves not silvery-downy beneath.
            Leaves pinnately-compound, the terminal leaflet not lobed; flowers in elongated or oval spikes, the calyx petaloid, 4-parted. *Sanguisorba* p. 464
            Leaves neither lobed nor compound.

Tree; fruit a single winged nutlet, mature in late May; leaves toothed with the base oblique; elm (Fig. 63, d, e). *Ulmus* p. 342

Shrubs; fruit a berry.

Flowers appearing in late April before the leaves appear; calyx-lobes 4; leaves entire; fruit reddish or yellowish (Fig. 97, g). *Thymelaeaceae* p. 523

Flowers greenish, June; calyx-lobes 5; leaves often serrate; fruit black (Fig. 97, c-e). *Rhamnus* p. 506

b. Plants herbaceous.

d. Plant less than 3 dm high, parasitic and forming witches' brooms on the branches of conifers (Fig. 64, e). *Arceuthobium* p. 346

d. Plant larger, not parasitic on conifers.

e. Pistils several to many; stamens numerous.

Calyx-tube constricted at the mouth, enclosing the pistils, 4-lobed. *Rosaceae* p. 429

Calyx-tube not enclosing the pistils. *Ranunculaceae* p. 386

e. Pistil one.

f. Leaves, at least the lower, deeply lobed or divided.

Leaves 5-10 cm wide, with a few wide lobes, and palmately veined.

Plants with leaves orbicular with shallow rounded lobes; low; flowers yellowish, very numerous, with the calyx-tube enclosing the fruit and 4-lobed (Fig. 87, d). *Alchemilla* p. 461

Plants vine-like or twining; leaves usually with 3 pointed lobes; pistillate flowers forming a short oval spike; hops. *Humulus* p. 343

Leaves with capillary division; plants aquatic.

Leaves repeatedly forked, the divisions toothed along one side. *Ceratophyllum* p. 383

Leaves pinnately divided, not toothed along one side of the divisions (Fig. 104). *Haloragaceae* p. 535

f. Leaves entire or merely toothed, or absent.

g. Leaves reduced to scales or absent.

Leaves small, scale-like, alternate; fresh-water habitats (Fig. 104, a). *Myriophyllum* p. 535

Leaves absent; branches opposite, very fleshy; salt marshes and shores (Fig. 69, a). *Salicornia* p. 368

g. Leaves green, prominent.

Leaves opposite or whorled.

Leaves whorled, 3-12 in a whorl.

Plants of sandy soils; flowers 4-5 mm wide, whitish-green on long pedicels, 2-5 at a node; prostrate weed. *Mollugo* p. 370

Water plant, erect and unbranched; leaves 6-12 at a node, linear and acuminate; flowers inconspicuous, without sepals. *Hippuris* p. 538

Leaves opposite.

Staminate and pistillate flowers separate, small, in clusters.

Stinging hairs abundant; stamens 4; nettles. *Urtica* p. 343

Stinging hairs absent; stamens 5-8. *Mercurialis* p. 491

Staminate flowers in the same involucre as the pistillate, or flowers perfect.

Leaves nearly round, obscurely and crenately lobed; plants low and matted, in wet locations (Fig. 81, f). *Chrysosplenium* p. 425

Leaves linear to oblong, entire.

Plants erect; calyx bell-shaped, pinkish, petal-like; of sea-shores (Fig. 113, a). *Glaux* p. 575

Plants prostrate; calyx small, greenish.

Plants with milky juice; staminate and pistillate flowers in an urn-shaped involucre; fruit triangular, 3-seeded (Fig. 93, c-f). *Euphorbia* p. 491

Plants without milky juice; flowers perfect, generally solitary in the leaf-axils.
Flowers pedicelled; ovary superior, forming a capsule with many seeds; rare chickweeds. *Stellaria* p. 377
Flowers sessile in the leaf-axils.
Ovary superior; fruit minute, flattened, separating into 2 portions; lower leaves linear, sessile (Fig. 94, c, d). *Callitriche* p. 494
Ovary inferior; fruit 4-sided with the 4 calyx-lobes at the tip; leaves lanceolate, short-petioled (Fig. 103, h). *Ludwigia* p. 526
Leaves alternate.
Stipules present, sheathing the stem above the nodes; calyx often corolla-like, 4-6-lobed (Fig. 65-67). *Polygonaceae* p. 347
Stipules not sheathing the stem, or absent.
Flowers included in a large palmately-lobed bract, axillary, both staminate and pistillate kinds; plant 2-6 dm high with ovate-lanceolate toothed leaves. *Acalypha* p. 491
Flowers not included in a lobed bract.
Fruit 3-angled and 3-seeded; flowers in a terminal and umbel-like compound inflorescence; juice milky. *Euphorbia* p. 491
Fruit 1- or 2-seeded; juice not milky.
Plant about 1 dm high, from running rootstocks; ovary inferior, forming a dryish or fleshy berry-like fruit. *Santalaceae* p. 345
Plants various, without running rootstocks, weedy.
Flowers in a terminal raceme; fruit roundish, flattened, 2-celled and 2-seeded; basal leaves often deeply lobed (Fig. 77, b). *Lepidium* p. 406
Flowers in large inflorescences; fruit a small achene.
Stinging hairs abundant; rare wood-nettle. *Laportea* p. 344
Stinging hairs absent; plants weedy.
Calyx-lobes papery; flowers surrounded by scarious bracts (Fig. 68, c). *Amaranthaceae* p. 370
Calyx-lobes fleshy; bracts absent (Fig. 68, 69). *Chenopodiaceae* p. 362

a. Calyx and corolla both present.
b. Corolla of separate petals (*Polypetalae*).
i. Stamens numerous, more than 10, and more than twice as many as the petals.
Plants aquatic; leaves mostly floating, large, peltate or deeply cordate; water-lilies (Fig. 72). *Nymphaeaceae* p. 384
Plants terrestrial; submersed forms may be found.
Filaments numerous, united into a tube about the pistil; pistils several, united in a ring or to form a several-celled ovary (Fig. 94, e, f). *Malvaceae* p. 508
Filaments not united in a tube; pistils not in a ring.
Leaves trumpet-shaped; insectivorous bog plants (Fig. 80, f). *Sarracenia* p. 419
Leaves flattened, not trumpet-shaped.
Sepals 2.
Juice milky or colored; petals 4-12, showy. *Papaveraceae* p. 398
Juice watery; prostrate garden weed with wedge-shaped, thick fleshy leaves; flowers yellow, very small (Fig. 69, c). *Portulaca* p. 371
Sepals more than 2.
Leaves punctate with translucent dots, entire, opposite; pistil one, stamens many (Fig. 99). *Hypericaceae* p. 510
Leaves not punctate, alternate. (check for Basswood).
Pistil 1, 1-celled, opening by 3-5 valves; low wiry herbs or shrubs; flowers minute, or else large and yellow; leaves simple, narrow. *Cistaceae* p. 514

Pistils several; or else one without several valves.
Stamens inserted on the receptacle; calyx usually colored or petal-like; stipules absent. *Ranunculaceae* p. 386
Stamens inserted on the calyx or on a raised disk; sepals green; stipules usually present. *Rosaceae* p. 429

i. Stamens 10 or fewer, rarely more than twice the number of the petals.
j. Shrubs, trees or vines.
k. Leaves compound or palmately lobed.
Leaves compound.
Leaves pinnately compound.
Leaflets entire, smooth; branches thorny; tree. *Leguminosae* p. 470
Leaflets serrate, downy beneath, lanceolate (Fig. 97, a). *Rhus* p. 498
Leaves palmately once or twice compound.
Leaflets 3-5, simple; ovary superior.
Leaflets mostly 3; tendrils absent; berries whitish, 1-seeded; short shrubby or low trailing plants (Fig. 97, b). *Rhus* p. 498
Leaflets mostly 5; tendrils present; berries becoming purplish, usually 4-seeded; long trailing vines. *Vitaceae* p. 507
Leaflets again divided into many divisions; ovary inferior; plant with a spiny, woody base (Fig. 105). *Aralia* p. 539
Leaves not compound, palmately lobed only.
Low shrubs; ovary inferior; fruit a berry; currants and gooseberries (Fig. 82). *Ribes* p. 426
Tall shrubs or trees; ovary superior; fruit a winged samara; maples (Fig. 98). *Aceraceae*. p. 501
k. Leaves neither lobed nor compound.
Introduced thorny shrubs, with the simple or 3-parted spine just below the leaves at each node; flowers with sepals, petals and stamens in 6's (Fig. 76, a); fruit a reddish berry. *Berberis* p. 398
Shrubs or trees without thorns or with the thorns in the axils of the leaves as in the hawthorns.
Flowers very irregular; ovary superior; fruit a capsule, persistent on the heath-like plants. *Ericaceae* p. 559
Flowers regular; fruit few-seeded.
Flowers in late autumn, with 4 narrow crinkled petals; fruit a persistent capsule; leaves ovate with wavy edges (Fig. 83, a). *Hamamelis* p. 428
Flowers in early summer; fruit berry-like.
Flowers few or clustered in the leaf-axils; ovary superior.
Stamens alternate with the petals; petals slightly joined at the base, or else linear and free; fruit 4-9-seeded (Fig. 96). *Aquifoliaceae* p. 499
Stamens opposite the petals and enclosed by the small rolled petals; fruit black, 2-4-seeded (Fig. 97). *Rhamnus* p. 506
Flowers numerous in a large flattish inflorescence; ovary inferior.
Petals large and conspicuous; thorns present,; hawthorns (Fig. 84, d, e). *Crataegus* p. 439
Petals minute; thorns absent; leaves not toothed, the veins curving toward the tip of the blade (Fig. 108). *Cornus* p. 552
j. Plants herbaceous.
l. Flowers extremely irregular; ovary superior.
Leaves compound.
Leaves but once divided; flowers with flaring lateral petals; fruit a pod or legume. *Leguminosae* p. 470

Leaves very finely divided, glaucous beneath, thin; petals not widely flaring (Fig. 76, d, e). *Fumariaceae* p. 400

Leaves not compound.

Petals 3; the two lateral sepals petal-like; neither sepals nor petals spurred (Fig. 92, g). *Polygala* p. 490

Petals 2 or 5, the flower conspicuously spurred.

Petals 5, the lower one spurred; flowers on long erect peduncles; violets (Fig. 100-101). *Violaceae* p. 516

Petals 2, each 2-lobed; lower sepal forming a large spurred sac; flower pendant on slender pedicels, often yellowish and spotted (Fig. 94, a, b). *Impatiens* p. 505

l. Flowers regular or but slightly irregular.

m. Leaves deeply-lobed, or compound.

n. Leaves compound with 3 leaflets (occasionally 4 or 5).

Leaflets heart-shaped, the margins untoothed; flowers yellow, or white veined with pink (Fig. 92, e, f). *Oxalis* p. 486

Leaflets widely lanceolate, coarsely toothed; flowers whitish.

Plants from a superficial thick root-stock; flowers in a short raceme; pistil superior; petals 4 (Fig. 80, b). *Dentaria* p. 417

Plant from a deep, globular tuber; flowers minute, in a simple umbel; ovary inferior; petals 5 (Fig. 102, d). *Panax* p. 540

n. Leaves finely divided or deeply lobed.

Plants aquatic; submersed leaves finely divided (Fig. 104). *Haloragaceae* p. 535

Plants terrestrial, or at least not floating.

Ovary superior.

Leaves pinnately divided; stamens 6.

Sepals and petals in 4's; petals white or yellow. *Cruciferae* p. 402

Sepals and petals in 3's; petals white, shorter than the sepals; flowers minute, on long pedicels in the leaf axils, solitary. *Floerkea* p. 498

Leaves palmately lobed or divided; sepals 5-6; petals 5-6.

Leaves ternately tri-compound, sessile; flowers greenish-yellow; styles 2. *Caulophyllum* p. 398

Leaves deeply lobed, petioled; ovary deeply lobed; style conspicuous (Fig. 93, a-c). *Geraniaceae* p. 487

Ovary inferior.

Plant a vine with tendrils; leaves palmately lobed (Fig. 125, e). *Cucurbitaceae* p. 647

Plant not vine-like, without tendrils; flowers in umbels, very small.

Styles 2; fruit dry, splitting at maturity into two halves. *Umbelliferae* p. 540

Styles more than 2; fruit berry-like, resinous-aromatic. *Araliaceae* p. 539

m. Leaves entire or but shallowly toothed.

o. Leaves mostly basal; plants often tufted.

Leaves provided with long gland-tipped bristles; plant insectivorous (Fig. 80, d, e). *Droseraceae* p. 420

Leaves without such bristles; plants not insectivorous.

Plants of salt marshes only; corolla bluish, papery (Fig. 111, a). *Limonium* p. 576

Plants never growing on brackish soil; corolla cream to white, not papery.

Ovary 1 or 2-celled; stamens inserted on the calyx; leaves thin; petals delicate, often lobed (Fig. 81, e-g).
Saxifragaceae p. 424

Ovary 5-celled; stamens 10, free from the calyx; leaves leathery; petals fleshy, never lobed. *Pyrolaceae* p. 554

o. Leaves scattered along the stem.

Pistils 3-5, separate; leaves thick and succulent (Fig. 81, a-d).
Crassulaceae p. 422

Pistil 1; leaves not succulent, or absent.

Leaves reduced to hollow thickened petioles; flowers white, small, in umbels; dwarf creeper near salt water in sw. N.S.
Lilaeopsis p. 548

Leaves with an expanded blade.

Ovary plainly inferior.

Flowers small, in a close cluster surrounded by usually 4 white or purplish large petal-like bracts (Fig. 108).
Cornus p. 552

Flowers not surrounded by petal-like bracts.

Leaves orbicular; flowers minute, in umbels; plants trailing and delicate; petals and stamens in 5's (Fig. 106, g).
Hydrocotyle p. 542

Leaves ovate to linear; flowers various, often large, the parts in 2's or 4's.

Leaves bristly along the margin and the 3 prominent veins, opposite, sessile (Fig. 103, g). *Rhexia* p. 525

Leaves not bristly, various. *Onagraceae* p. 525

Ovary superior; flowers not in umbels.

Middle and upper stem-leaves alternate.

Leaves thick, leathery, evergreen; plant woody near the base and usually trailing; petals 5; stamens 10. *Ericaceae* p. 559

Leaves not leathery, the upper not evergreen.

Petals 4; sepals 4; stamens 6. *Cruciferae* p. 402

Petals 3 or 5; sepals 5; stamens 3 to many.
Cistaceae p. 514

Middle and upper stem-leaves opposite.

Leaves with punctate translucent dots (Fig. 99).
Hypericaceae p. 510

Leaves without punctate translucent dots.

Flowers sessile, axillary, the parts in 2's; seeds visible through the capsule wall, with rounded pits; plants small (Fig. 94, h). *Elatinaceae* p. 514

Flowers not sessile.

Stamens equal in number to the petals, opposite them and adherent to the petal base.

Sepals 2; stamens 3 or 5; styles 3, or 1 and 3-cleft.
Portulacaceae p. 371

Sepals 5; stamens 4-8; style 1. *Primulaceae* p. 571

Stamens not of the same number as the petals, or alternate with them if so.

Flowers whorled in the leaf-axils or in a tall interrupted spike (Fig. 103, a). *Lythraceae* p. 524

Flowers not whorled.

Ovules and usually seeds several to many in each cell; plants succulent; petals often 2-lobed; chickweeds and pinks. *Caryophyllaceae* p. 372

Ovules and seeds 1 or 2 in each cell; plants slender and wiry; petals not lobed (Fig. 92, c, d). *Linaceae* p. 485

h. Corolla with the petals more or less united (*Sympetalae*).
p. Stamens more numerous than the corolla lobes.
Leaves compound.
Leaves finely divided, thin, glaucous beneath; flowers very irregular (Fig. 76, d, e). *Fumariaceae* p. 400
Leaves but once compound.
Flowers regular, belt-like; leaflets 3, obcordate; fruit a capsule (Fig. 92, e, f). *Oxalidaceae* p. 486
Flowers very irregular; leaflets not as above except in the clovers; fruit a pod. *Leguminosae* p. 470
Leaves simple, sometimes deeply-lobed palmately.
Filaments very numerous, united in a tube about the pistil; leaves palmately lobed; herbs. *Malvaceae* p. 508
Filaments not united in a tube; leaves simple; plants shrubby. *Ericaceae* p. 559
p. Stamens not more numerous than the corolla lobes.
r. Stamens of the same number as the lobes and opposite them; flowers regular; ovary superior.
Style 1; plants of non-brackish habitats *Primulaceae* p. 571
Styles 5; plants of salt marshes; inflorescence much branched with small papery lavender flowers; fruit a one-seeded sac (Fig. 111, a). *Limonium* p. 576
r. Stamens alternate with the corolla lobes or fewer.
s. Flowers not in a dense head on a common receptacle nor surrounded by a scaly involucre.
t. Shrubs.
Leaves alternate, or linear and crowded.
Style absent; flowers clustered in the leaf-axils, regular; fruit berry-like, 3-8-seeded; tall shrubs (Fig. 96). *Aquifoliaceae* p. 499
Style 1; flowers mostly in a terminal inflorescence or solitary.
Flowers mostly numerous in a terminal inflorescence, often irregular; low heath-like plants. *Ericaceae* p. 559
Flowers solitary, white; plant densely matted with crowded linear leaves; rare alpine. *Diapensia* p. 571
Leaves opposite. (Lilac keys out here).
Flowers in a dense spherical head, white, small, regular; sw. N.S. only (Fig. 126, a); corolla with 4 lobes. *Cephalanthus* p. 638
Flowers not in a dense head, irregular if crowded; corolla 5-lobed (Fig. 126-7). *Caprifoliaceae* p. 640
t. Herbaceous plants.
u. Plants parasitic, without green color or nearly so.
Plants twining, attached to the stems of other plants and forming a mass of intertwined slender threads; capsule 1-4-seeded (Fig. 114, f). *Cuscuta* p. 587
Plants stout, erect, rooted in the soil or parasitic on roots; capsule many-seeded (Fig. 123, a, b). *Orobanchaceae* p. 624
u. Plants not markedly parasitic, green.
v. Flowers quite irregular.
Aquatic plants or rooting in wet mud; leaves absent or finely divided; bladders present, sometimes in the wet substrate; insectivorous plants (Fig. 122). *Utricularia* p. 625

Terrestrial; bladders absent, leaves not finely divided.
Ovary superior; anthers not united in a tube.
Ovary deeply 4-lobed; fruit of 4 small nutlets.
Leaves alternate, often rough-hairy; inflorescence coiled when young, gradually uncoiling as the flowers progressively open; flowers often blue.
Boraginaceae p. 589
Leaves opposite; inflorescence not coiled; plants often aromatic; mint family. *Labiatae* p. 594
Ovary not deeply lobed, the style coming from the apex; fruit a capsule.
Leaves scattered on the stem; ovary and fruit 2-celled with many seeds. *Scrophulariaceae* p. 609
Leaves all basal; plants small and rare.
Leaves linear; corolla nearly regular, not spurred (Fig. 119, d). *Limosella* p. 615
Leaves elliptical or wider; flowers solitary, with the corolla very irregular and spurred.
Pinguicula p. 629
Ovary inferior; anthers 5, united in a tube about the pistil; fruit a many-seeded capsule; flowers very irregular (Fig. 129, d, f). *Lobelia* p. 649

v. Flowers regular or nearly so.
w. Leaves in a basal rosette; flowers solitary or in dense spikes, small and insignificant. *Plantaginaceae* p. 630
w. Leaves usually scattered along the stem.
x. Ovary superior.
y. Leaves opposite, or else all basal.
Filaments united in a tube, covered with a crown of 5 hooded and spurred bodies; juice milky; fruit of 2 follicles (Fig. 114, g). *Asclepias* p. 585
Filaments not united; a crown not present.
Juice milky; ovaries 2, forming follicles (Fig. 114, a, b, c). *Apocynaceae* p. 583
Juice not milky; ovary 1; fruit not a follicle.
Ovary 3-celled; capsule 3-celled; corolla rolled in the bud, with a slender tube and flaring limb (Fig. 115, a). *Phlox* p. 589
Ovary not 3-celled.
Leaves deeply lobed or palmately divided near the base of the plant; flowers small, blue, in a long spike (Fig. 115, g). *Verbena* p. 594
Leaves entire, or toothed only.
Ovary deeply 4-parted, with the style arising between the lobes; fruit of 4 nutlets; plants often aromatic; mint family. *Labiatae* p. 594
Ovary not deeply lobed; fruit a many-seeded capsule.
Flowers regular; capsule 1-celled.
Gentianaceae p. 579
Flowers usually slightly irregular; capsule and ovary 2-celled. *Scrophulariaceae* p. 609
y. Leaves alternate or lily-like and floating.
Leaves floating, lily-like; flowers white, borne near the surface, small, in an umbel (Fig. 113, g).
Nymphoides p. 583

Leaves not lily-like nor floating.
Leaves with 3 thickish leaflets; flowers in an erect raceme; bogs (Fig. 113, d). *Menyanthes* p. 583
Leaves entire, or finely divided, or lobed.
Plants long-trailing; leaves sagittate or hastate; flowers large, funnel-form (Fig. 114, c, d). *Convolvulus* p. 586
Plants not long-trailing, or if slightly so then woody.
Ovary deeply 4-lobed, with the style arising between the lobes; inflorescence coiled when young and uncoiling as the flowers open. *Boraginaceae* p. 589
Ovary not deeply lobed; inflorescence not coiled when young.
Ovary 3-celled; capsule 3-celled. *Polemoniaceae* p. 588
Ovary 2-celled; fruit 2-celled.
Fruit a capsule; flowers less than 1 cm wide, usually slightly irregular. *Scrophulariaceae* p. 609
Fruit a berry or rarely a capsule; flowers over 1 cm wide, perfectly regular. *Solanaceae* p. 606

x. Ovary inferior.
Plant a vine; leaves deeply and palmately 5-lobed; corolla-lobes 6; tendrils present; wild cucumber (Fig. 125, e). *Echinocystis* p. 647
Plant not a vine; leaves not palmately lobed.
Leaves deeply and pinnately lobed (Fig. 125, f). *Valeriana* p. 546
Leaves entire.
Leaves alternate. *Campanulaceae* p. 647
Leaves opposite or whorled.
Leaves opposite, without stipules; corolla 5-lobed. *Caprifoliaceae* p. 640
Leaves whorled and the corolla 5-lobed. *Rubiaceae* p. 633

s. Flowers in a dense head on a common receptacle, surrounded by an involucre of bracts, the outer of which may be leafy.
Stamens 4, not united; heads subglobose; flowers bright blue; chaff or bracts mixed with the flowers and of about the same length (Fig. 129, e). *Succisa* p. 646
Stamens 5, their filaments united in a tube about the style. *Compositae* p. 650

30. SALICACEAE WILLOW FAMILY

The Willow Family includes the willows and the poplars. The flowers are in pistillate and staminate catkins, usually on separate shrubs. Each pistillate flower consists of a single ovary without a perianth, subtended by a simple or lobed bract. The staminate flowers consist of one to many stamens. The fruit is a many-seeded capsule,

each seed with a tuft of long silky hairs. Trees and shrubs, flowering in early spring.

a. Buds with a single scale; bracts of the catkin entire or merely toothed; stamens few, generally 1-5; flowers with one or two small glands at the base of the stamens or pistil; willows. 1. *Salix*

a. Buds with several scales; bracts of the catkins deeply cut with sharp lobes; stamens many, generally more than 5; flowers without glands; poplars. 2. *Populus*

1. SALIX L. WILLOW

Willows, in general, comprise one of the more difficult groups to name correctly. Their variability, tendency to hybridize, and their similarity in appearance make considerable field work essential. In most cases pistillate and staminate catkins can be found on neighboring bushes.

Only a few species make up the majority of the types found in our area. In early spring *S. discolor* and *S. humilis* are the common pussy-willows. Later, *S. Bebbiana* will comprise the majority of the willows seen in the open country and is probably the most common willow of the Province. *S. pyrifolia* will shortly follow, growing mostly in wet ground and swales, conspicuous because of its bright twigs and yellow-reddish leaves. *S. rigida* is everywhere along our brooks and rivers; *S. lucida*, with numerous stamens and large, glossy, long-tailed leaves, is more restricted to sand-bars. By far the commonest tree-willow is the introduced *S. alba*. The best time to study the willows is in the spring and early summer before the pistillate catkins mature. The mature leaves are so variable that it is almost impossible to make a key that will separate all the various forms.

a. Depressed creeping shrubs with small rounded leaves; very rare in northern C.B.
Stamen 1; ovary and capsule glabrous or nearly so; young branches and leaves sparingly pubescent to glabrous. 5. *S. Uva-ursi*
Stamens 2; ovary and capsules densely pubescent; young branches and leaves silky-villous. 6. *S. cordifolia*

a. Upright shrubs or trees.

b. Low shrubs to 1 m high; very rare in bogs or wet meadows; capsules on leafy-bracted peduncles.
Young twigs and lower surfaces of the leaves densely whitish-woolly even when fully mature; capsules 6-8 mm long, subsessile. 15. *S. candida*
Young twigs, leaves and catkins entirely glabrous; leaves small, without teeth, the smaller elliptical to oval and rounded on the tip. 11. *S. pedicellaris*

b. Larger shrubs or trees.

c. Large introduced trees; younger growth erect and fast-growing.

d. Leaves ovate-lanceolate, about 3 times as long as wide, shining glossy above; stamens 5; catkins on leafy peduncles, long-persisting; capsule glabrous. 1. *S. pentandra*

d. Leaves lanceolate, more than 3 times longer than wide.

e. Leaves glabrous or nearly so beneath, even when young.

f. Ovary pubescent and sessile; stamens with the filaments and sometimes the anthers fused together; anthers red; catkins appearing just before the leaves; leaves sub-opposite, bluish-green, entire or with teeth only near the tip. 19. *S. purpurea*

f. Ovary glabrous; stamens separate, 2, yellow; catkins appearing with the leaves, the peduncles leafy-bracted; leaves finely toothed.
Leaves with 4-6 serrations per cm; twigs very brittle at the base; ovary short-stalked, the staminate flower with 2 glands; leaves promptly glabrous. 3. *S. fragilis*
Leaves with 7-9 serrations per cm, usually slightly silky-pubescent beneath; ovary almost sessile, the flower with 1 gland; twigs not brittle and do not snap off at the base. 4. *S. alba*

e. Leaves densely hairy beneath; ovary and capsule minutely pubescent.
Leaves small and narrow, mostly under 1 cm wide; hairs on the lower surface silvery-silky and closely appressed; filaments glabrous; capsules sub-sessile. 17. *S. viminalis*
Leaves up to 2.5 cm wide, the sides rounded at the middle, softly pubescent above and beneath; capsules with the pedicels about 0.5 mm long and much shorter than the long lanceolate scales. 18. *S. Smithiana*

c. Shrubs over 1 m high, sometimes with a single trunk but not becoming large trees.

g. Catkins appearing before the leaves; ovaries and capsules pubescent with dark, often black, scales.

h. Stamens united up to the anther or more; anthers red; ovary sessile with 2 glands at the base; buds sub-opposite; catkins small and dark. 19. *S. purpurea*

h. Stamens separate, 2; flowers with 1 gland; buds alternate

i. One-year old twigs more or less dirty grayish-pubescent; staminate catkins oval, with red anthers; ovary gray-pubescent. 13. *S. humilis*

i. One-year old twigs glabrous or essentially so; anthers yellow.

j. Stamens with pubescent or pilose filaments; ovary long-tapering with pedicel 1.5-3 mm long; catkins very early; common. 12. *S. discolor*

j. Stamens with glabrous filaments or only pilose at the base; ovary minutely to densely silky-pubescent; rare or introduced.

k. Stamens pilose at base; ovary short and blunt, with practically no style, short-silky, with pedicel around 1 mm long. 14. *S. sericea*

k. Stamens with glabrous filaments; ovary sessile or nearly so, rather densely silky-pubescent; styles long, 1 mm or more.
Twigs slender, yellowish, without a bloom; introduced, becoming a tree. 17. *S. viminalis*
Twigs stout, olivaceous to reddish, often with a whitish bloom; native shrub of wet areas, rare. 16. *S. pellita*

g. Catkins appearing after the leaves or at the same time, or earlier and now with expanded leaves present.

l. Leaves closely glandular-serrate or serrulate (very young leaves and bracts may not show this characteristic).

m. Ovary glabrous; staminate flowers often with 2 glands; leaves not silky-lustrous beneath.

n. Stamens 3-7, usually 5; leaves quickly glabrous, bright green and glossy above, widely lanceolate or obovate, distinctly glandular at the top of the petiole and on the lower teeth.
Cultivated, or roadside escape; stalk of the staminate catkin 2 cm long, the bracts more than 1 cm wide; pedicels of the ovaries twice as long as the glands; leaves short acuminate, paler beneath; branches brownish-green. 1. *S. pentandra*
Native on river-shores; stalks of staminate catkins 1 cm long, the bracts less than 1 cm wide; pedicels of the ovaries 2-4 times as long as the glands; leaves very long-pointed; branches yellowish-brown. 2. *S. lucida*

n. Stamens 1-2 (rarely 3-5 in *S. alba*); leaves not bright green and glossy above.

o. Staminate flowers with 2 glands at the base; pistillate bracts pale yellowish, early deciduous; catkins long and slender, to 8 cm long and about 5 mm thick; leaves narrowly lanceolate, tapering to the very short petioles; becoming trees.

See earlier key to *S. alba* and *S. fragilis*

o. Staminate flowers with 1 gland; pistillate bracts persistent; catkins shorter and denser, usually 1 cm thick or more; much-branched shrubs.

p. Leaves short-oval to oblong-lanceolate, rugose when young and very veiny beneath, often cordate at the base, with a reddish-yellow tinge and glabrous from the first; stipules absent or quickly so; branches deep brown. 7. *S. pyrifolia*

p. Leaves narrowly to widely lanceolate; stipules often present; young twigs and leaves pubescent.

Leaves broad, $\frac{1}{2}$ to $\frac{2}{3}$ as wide as long, rounded to cordate at the base, greenish and more permanently woolly beneath; capsules crowded on short pedicels much shorter than the bracts. 8. *S. cordata*

Leaves lanceolate, $\frac{1}{3}$ to $\frac{1}{2}$ as broad as long, reddish and woolly when young, becoming glabrous; capsules on pedicels usually longer than the small bracts. 9. *S. rigida*

m. Ovary with silky appressed hairs; leaves lanceolate and lustrous beneath with silky hairs; capsule 3-4 mm long, blunt with practically no style; catkins early with blackish scales. 14. *S. sericea*

l. Leaves sparingly dentate, wavy-margined, or entire; capsules pubescent.

q. Leaves glabrous; catkins appearing before the leaves, with black scales.

r. Leaves oblanceolate, sub-opposite; fruiting catkins small and cylindric with capsules sessile and only 2-3 mm long. 19. *S. purpurea*

r. Leaves alternate or in a spiral; capsules over 6 mm long; leaves widely lanceolate to elliptic or obovate, green above and whitish beneath; fruiting catkins large, over 1 cm wide, naked at the base, with capsules long-pointed and 7-12 mm long. 12. *S. discolor*

q. Leaves pubescent beneath.

s. Leaves widely lanceolate to obovate, up to 3½ times as long as wide, rough-pubescent beneath.

t. One year twigs usually grayish-pubescent; catkins before the leaves, without leafy bracts at the base, dense with the capsules short-pediceiled; bracts black. 13. *S. humilis*

t. One-year old twigs glabrous; catkins with leafy bracts at base, open; bracts pale yellow in the catkins.

u. Fast-growing introduced small tree; branches olive; leaves bright green, tapering to both ends; catkins dense with capsules having pedicels much shorter than the bracts. 18. *S. Smithiana*

u. Much-branched and our most common native shrub willow; leaves dull, becoming rugose above; young branchlets reddish; catkins short and loose, with the pedicels of the capsules much longer than the scales and 2-4 mm long. 10. *S. Bebbiana*

s. Leaves narrowly lanceolate, less than 2 cm wide, 5-10 times longer than wide; shining silky-pubescent beneath.
v. Hairs on lower surface silky and closely appressed; margin of leaf not strongly inrolled; leaves small, to 7 cm long and 5-7 mm wide; introduced tree. 17. *S. viminalis*
v. Hairs on lower surface tangled and erect; margin of leaf strongly inrolled; leaf larger and coarser, to 10 cm long; coarse shrub with the branches often with a whitish bloom. 16. *S. pellita*

1. **S. pentandra** L. Fig. 58. BAY-LEAVED WILLOW

Named because of its five stamens and distinguished by its thick, bright-green, glossy leaves. This willow is occasionally planted as a hedge plant or tree; the pistillate catkins remain on the tree until autumn.

Introduced from Eu. and sparingly escaped in eastern Canada and the U.S.A.

2. **S. lucida** Muhl. Fig. 58. Map 229. SHINING WILLOW

Scattered and sometimes common along wider streams, sand bars, and sandy edges of lakes, even occasionally in wet ground or ditches; most common from Digby to northern C.B., and scattered elsewhere. The bright-glossy leaves with acuminate tips are quite distinctive.

Var. **angustifolia** Anderss. is a smaller bush with rather narrowly lanceolate leaves 3-8 cm long and up to 2 cm wide. This is sparingly found in the northern part of the range from Lab. to Man. and ranging south to N. S. and New Eng. Occasionally seen, as at South River, Victoria Co.

Lab. to B.C. south to Del., Ind. and Iowa.

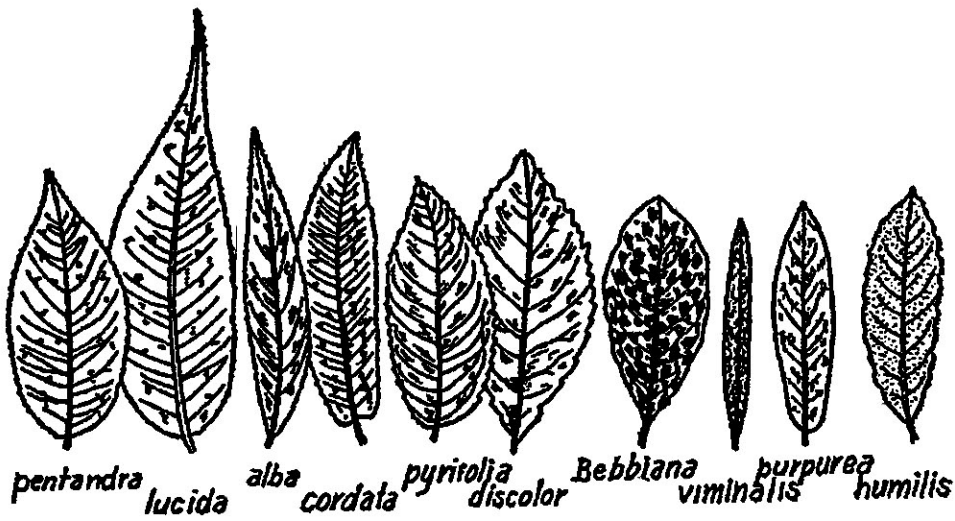


Fig. 58.—Salix spp., typical leaves x ½.

3. **S. fragilis** L. CRACK-WILLOW

This willow, which forms a large tree, is occasionally planted in the Province and seems to be more common in the eastern counties. It is very similar to *S. alba* in appearance but the branches are very brittle at the base so that they snap off very readily when bent backwards. Many of our trees are probably hybrids with this species and it is difficult in many cases to separate them satisfactorily from *S. alba*. It is usually found as old trees along roadsides or in neglected areas.

Eu. and western Asia; long cultivated.

4. **S. alba** L. WHITE WILLOW

The "French willow" is another fast-growing willow which reaches the stature of a large tree. Varieties exist which differ slightly in pubescence of the leaves or color of the branches. The typical form has branches olive-brown and the leaves are finely silky beneath. The most common variety is var. **vitellina** (L.) Stokes, which has yellow branches and leaves only slightly silky beneath. This is considered to be a hybrid of *S. alba* and *S. fragilis*. Var. **calva** G. F. W. Mey has the dark brown branches with leaves practically glabrous beneath. *S. alba* was formerly much planted as an ornamental and in parts of the Province, as about Truro and in the eastern part of the Annapolis Valley, it frequently escapes and vigorous young bushes may be seen.

Early introduced from Eu. and widely grown.

5. **S. Uva-ursi** Pursh BEARBERRY WILLOW

Collected by Perry and Roscoe on a wind-swept barren St. Paul I. off northern C. B., 1930.

Greenland and Baffin I. south to the barrens of Nfld., N. S. and the alpine areas of Que., New Eng. and N. Y.

6. **S. cordifolia** Pursh var. **callicarpaea** (Trautv.) Fern.

As with the last, this species is known only from a barren on St. Paul I.

Greenland and arctic Canada south to Nfld., N.S. and Gaspé.

7. **S. pyrifolia** Anderss. Fig. 58. Map 230. BOG-WILLOW

Swampy thickets, poorly-drained areas, bogs and heavy soils throughout the northern region from Digby Co. to C.B. but not generally common; rare near the Atlantic coast; not known from northern C.B. This is one of our most distinctive and conspicuous species, especially in early spring.

Lab. to northern B.C. south to New Eng., n. N.Y. and Wisc.

8. **S. cordata** Michx. Fig. 59, c. HEART-LEAVED WILLOW

This willow is not common but does occasionally occur in central and eastern N.S. and to northern C.B., gravelly or sandy shores of rivers

or on sandy beaches of lakes. It is difficult to separate from the following species and may hybridize with it. The leaves are usually larger, wider and more cordate at the base.

Var. **abrasa** Fern. has the branchlets, petioles and leaf-blades glabrous or promptly so. This occurs from Nfld. south to N.S. and n. Me.

Lab. to northern Ont. south to Mass., n. N.Y. and n. Mich.

9. **S. rigida** Muhl.

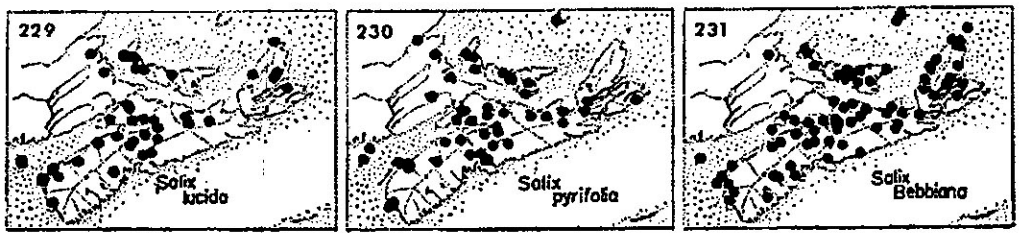
Scattered throughout and especially common in central and eastern N.S. where it grows along every stream and river both on the banks and out onto the bars, varying from slightly over 1 m high on new bars to a very tall shrub on old riverbanks. This species is very variable in pubescence, width and shape of the leaves, and length of pedicel so that neighboring bushes may look rather unlike. Plants with leaves gradually tapering or rounded to the base and up to about 2 cm wide have been designated var. **angustata** (Pursh) Fern. It is doubtful if this narrow-leaved form is more than a variation here.

Nfld. to Ont. south to N.C., Miss. and Kans.

10. **S. Bebbiana** Sarg. Fig. 59, a, b. Map 231. BEAKED WILLOW

This most common willow of the Province is found throughout in many habitats from wet to open, dryish soils. Occasionally large shrubs or small trees may be found with the leaves and twigs nearly glabrous and the leaves smooth instead of rugose. This approaches var. *perrostrata* (Rydb.) Schneid. which is a northern and western variety. The opposite extreme with leaves densely tomentose or cinereous-tomentose beneath and with the twigs densely pubescent to the second year is var. **capreifolia** Fern. This was reported as small trees in woods and thickets at the margin of Lily L., Sandy Cove (Fernald, 1921). (*S. rostrata* Richards).

Nfld. to Alaska south to Penn., Ohio and Iowa.



11. **S. pedicellaris** Pursh var. **hypoglauca** Fern. Map 239.

Common in a sphagnous swale north of Middlefield, Queens Co., found by C. A. Weatherby in the summer of 1941; now known to be common on the flood-plain of the Medway River at Charleston and in 18-Mile Bog in the same county; also found in 1944 in a meadow at Upper Musquodoboit; occasional in a wet meadow along Sharpe Brook

at Cambridge, Kings Co. The variety is the more common form, with the leaves whitish and glaucous beneath.

Lab. to B.C. south to Nfld., N.S., Penn. and Iowa.

12. **S. discolor** Muhl. Fig. 58. PUSSY-WILLOW

Common throughout on low ground, in wet pastures, along the edges of swamps and in damp open woods. It is the earliest of our willows and is conspicuous in early spring. The leaves are ordinarily smooth and glaucous beneath. The species is rather variable and hybridizes to a considerable extent when it is growing in the same local area as *S. humilis*. The twigs then may be slightly grayish pubescent and the stamens of intermediate colors between yellow and red. Bushes have also been found with leaves finely pubescent beneath, which seem to be hybrids with *S. Bebbiana*. Under suitable conditions this species forms a small tree.

Lab. to B.C. south to Nfld., N.S., Del., Ky. and Mo.

13. **S. humilis** Marsh. Map 232. SMALL PUSSY-WILLOW

Widely distributed on clay soils, low ground and in sterile areas, generally smaller and on poorer soils than the preceding species. Typical plants have a dirty appearance, with grayish-woolly young shoots and undersides of the leaves; anthers reddish. On sandy soil at Debert, Colchester Co., the species seemed to hybridize freely with *S. discolor*, giving various combinations and shades of anther color with pubescent and smooth twigs.

Scattered from sw. N.S. to Antigonish Co. are shrubs with wider leaves, the lower almost orbicular, having the lower surface densely covered with a velvety or satiny lustrous pubescence, and often with a reddish tinge. This variation has been referred to as var. **keweenawensis** Farw.; it is scattered in the eastern part of the range of the species.

Nfld. to Alta. south to N.C., and Kans.

14. **S. sericea** Marsh. SILKY WILLOW

Rare in western N.S.; scattered east to Grand Lake in Halifax Co. in low thickets and along the banks of streams. This plant is rare and little collected in N.S. Our only collection is from thickets along the LaHave R., at Pinehurst in Lunenburg Co.

N.S. and s. Que. to Wisc. south to S.C., Tenn. and Mo.

15. **S. candida** Flügge HOARY WILLOW

Rare, a low shrub in Black River Bog, Inverness Co., recognizable because of the dense white tomentum on the younger branches. Even in this alkaline bog the shrubs are small and very scarce.

Lab. to B.C. south to Nfld., Penn. and Iowa.

16. **S. pellita** Anderss.

Stated by Rousseau (1938-a) to be common in the region of Canso; seen occasionally elsewhere in the interior where it is scattered and the distribution poorly known; north of Five Islands and above Parrsboro along the Halfway R., and its lakes in Cumberland Co.; along the Stewiacke R.; and at Ball's Creek in C.B. Co. It is easily confused with luxuriant shoots of the next species and care must be taken to separate these two.

Nfld. and Lab. to northern Ont. south to N.S., n. New Eng. and n. Mich.

17. **S. viminalis** L. Fig. 58. COMMON OSIER

Scattered, usually found as a large tree, also as an occasional escape from cultivation, more or less throughout. A rather similar-appearing small shrub named *S. incana* Schrank, with linear-lanceolate small leaves which are inrolled on the margins, and with fruiting catkins only 1-2 cm long, has been reported from N.S. in Gray's Manual but no specimens have been seen.

Spread from cultivation from Nfld. to Ont. and New Eng.; introduced from Eu.

18. X **S. Smithiana** Willd.

This hybrid willow is occasionally planted and may occur as an escape. Fernald (1921) reports it as naturalized on a clay bank by the sea, Baddeck, Victoria Co. It is now a common and handsome large shrub or small tree about the town.

P.E.I. and N.S. to New Eng. and Wisc.

19. **S. purpurea** L. Fig. 58. PURPLE OSIER

Abundantly naturalized about Yarmouth, Wolfville and probably other towns of the Province; rare in the country. This large bush or small tree was formerly planted as an ornamental but recent introductions are not known. It is rather distinctive both in flower and in leaf; it is our only species with the filaments fused so that there is apparently only one stamen.

Eurasia and Africa; long cultivated.

2. POPULUS L. POPLAR, ASPEN

Trees producing elongate catkins in early spring and maturing seed before the leaves are fully expanded. Staminate flower of 5-many stamens on short filaments; the pistillate one an ovary producing many silky-tufted seeds; each type of flower subtended by a deeply-toothed or lobed bract.

a. Leaves permanently whitish woolly beneath, often palmately lobed; petioles terete; buds tomentose. 3. *P. alba*

a. Leaves glabrous or becoming so, or lightly pubescent only.
b. Petioles flattened; buds neither very large nor viscid.
c. Leaves without a translucent border, the teeth mostly rounded at the summit.
d. Leaves usually wider than long, finely toothed or crenate-serrate; winter-buds glossy and shiny (Fig. 59, c). 1. *P. tremuloides*
d. Leaves ovate, coarsely toothed; winter buds white-pubescent (Fig. 59, g). 2. *P. grandidentata*
c. Leaves with a clearly defined translucent border and the teeth terminating in an inturned calloused point, glabrous.
e. Leaves wedge-shaped at the base, rather small, 4-6 cm wide; branches strongly ascending; columnar introduced tree. 4. *P. nigra*
e. Leaves truncate or broadly cuneate at the base, larger; branches spreading. 5. *P. canadensis*
b. Petioles terete, not flattened; leaves whitish beneath; buds very large and viscid (Fig. 59, f).
f. Twigs glabrous; leaves rounded to slightly cordate at the base, rather narrow, glabrous beneath. 6. *P. balsamifera*
f. Twigs pubescent; leaves cordate, slightly pubescent on both sides and densely so on the veins beneath, wide and often slightly cordate. 7. *P. gileadensis*

1. **P. tremuloides** Michx. Fig. 59, e. TREMBLING ASPEN

Common throughout, mixed with or often growing on wetter land than the following species. Aspen rarely occurs in large stands except in burnt-over areas but most frequently occurs scattered with other trees. There is considerable variation in the size and the shape of the leaves. The extreme with leaves slightly cordate at the base and with the blades as wide or wider than long is probably best considered as a form, forma *reniformis* Tidestr. This is occasional in Kings and Colchester Co. eastward and probably throughout eastern Canada.

Lab. to Alaska south to Tenn. with other varieties westward.

2. **P. grandidentata** Michx. Fig. 59, g. Map 233. LARGE-TOOTHED POPLAR

Common throughout the mainland, rather rare in C.B.; this species formed only a small part of the original forest but is now common on light soils or burnt-over areas; especially abundant in the Annapolis Valley and in northern Colchester Co. This species suckers or becomes established by seed readily after fires and has frequently covered large areas on the lighter soils. It rarely crosses with *P. tremuloides*. One such cross was found by J.S. and D.S. Erskine at the foot of a gypsum slope by Ellerhouse Brook, St. Croix in Hants Co.

N.S. to Man. south to N.C. and Mo.

3. **P. alba** L. WHITE POPLAR, SILVER POPLAR

Commonly planted around buildings and along roadsides in the past, almost impossible to eradicate when once established since it produces an abundance of root-suckers. Most of the trees recently planted as ornamentals belong to var. **nivea** Ait., with the leaves silvery-tomentose beneath and the blades lobed like a maple leaf.

Eurasia; widely introduced.

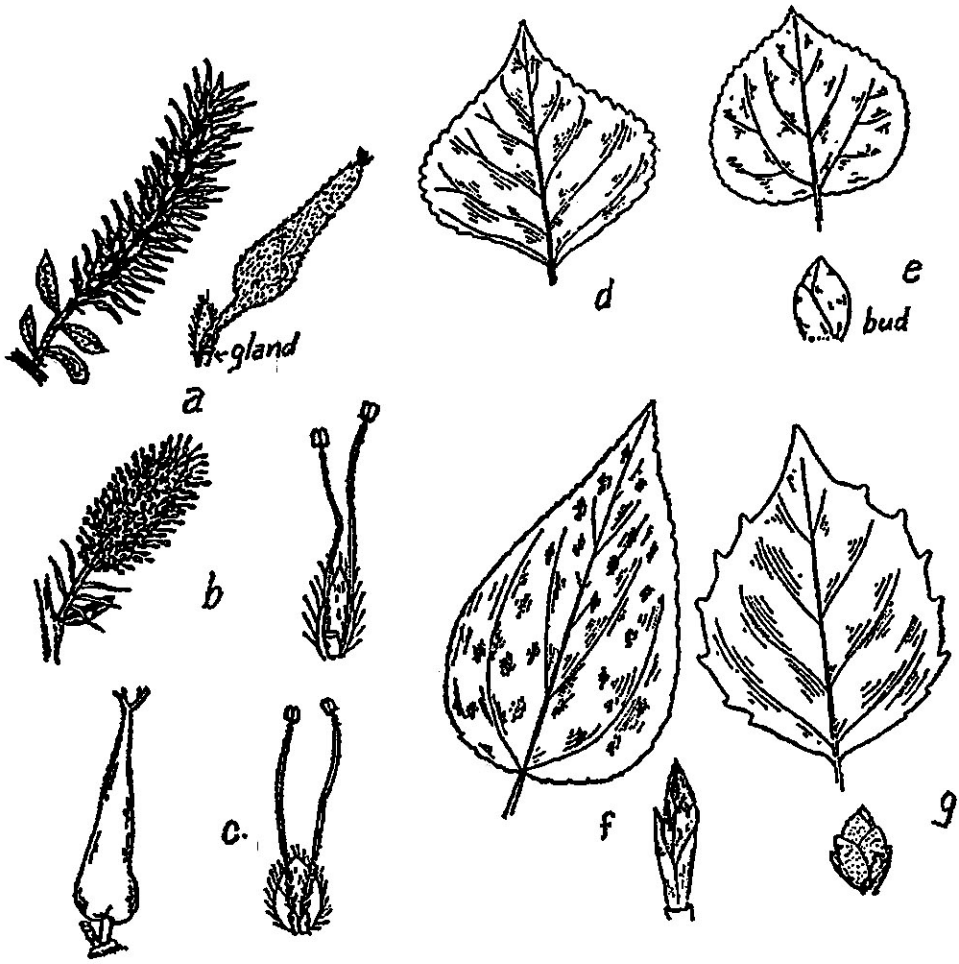


Fig. 59.—Salix: (a) *S. Bebbiana*, pistillate catkin x ½, flower x 5, (b) staminate catkin x ½, flower x 5, (c) *S. cordata*, pistillate and staminate flowers x 5. — Populus: (d) *P. nigra*, leaf, (e) *P. tremuloides*, (f) *P. balsamifera*, (g) *P. grandidentata*.

4. **P. nigra** L., var. **italica** Muenchh. Fig. 59, d. LOMBARDY POPLAR

This tall columnar tree is occasionally seen along roadsides and about buildings, probably gradually dying out and only infrequently escaping. This is reported to be an infertile clone which is spread only by cuttings or sprouts. The species itself does not have the strict columnar form.

Native of Eu. and early introduced into N.Amer.

5. X **P. canadensis** Muenchh. HYBRID POPLAR

Various forms and varieties of these hybrid poplars are now being planted in the Province along roadsides and especially about towns where they excel because of their fast-growing habit and good foliage; subject to cankers.

6. P. **balsamifera** L. Fig. 59, f. Map 234. BALSAM POPLAR

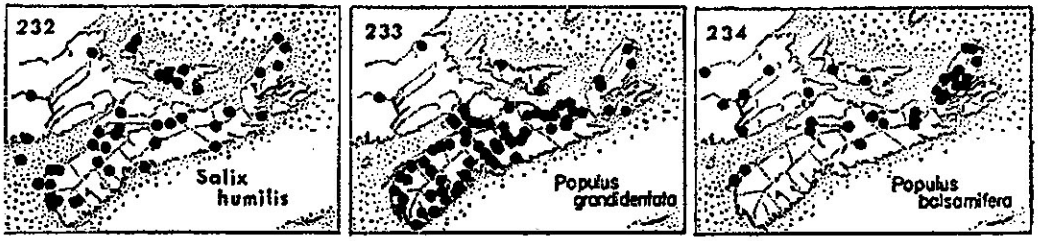
Common along streams and open intervales, occasionally seen in the original forest, in central and northern C.B.; formerly planted as a shade tree so it has become more scattered. Young trees are occasionally found on the mainland as far as Cumberland, Digby and Halifax Co, in native habitats but where it is difficult to be certain whether they are introduced or not. The trees are conspicuous in early summer because of the dark shade of the foliage. The species in the east has wider, more ovate leaves which may even be subcordate at the base. This variation has been given various names but may be called var. **subcordata** Hylander (Var. *Fernaldiana* Rouleau; var. *Michauxii* (Dode) Henry). See Rouleau (1946, 1948) for a discussion of the nomenclature.

Lab. to Alaska south to Conn., Ind. and Nev.

7. X P. **gileadensis** Rouleau BALM-OF-GILEAD

Rare, probably throughout, and scattered collections have been made from Shelburne and Queens Co. east to Pictou. It is rather similar in appearance to the last species, and, like it, in the past was planted as an ornamental, and now survives as isolated trees or occasionally as clumps around old houses, deserted cellars or on roadsides. Both these species make inferior shade trees and are now being replaced by newer hybrids. Its origin is unknown but it may possibly be a hybrid with the last species, apparently originating in Eu. (*P. candicans* Ait.).

Nfld. to Sask. south into the U.S.A.



31. MYRICACEAE SWEET GALE FAMILY

Low much-branched wiry shrubs with alternate, simple leaves which are resinous-dotted beneath and often fragrant; flowers unisexual, in globose to cylindric catkins.

a. Leaves merely toothed; bracts at base of the ovary 2-4, deciduous in fruit; fruit not surrounded by a bur. 1. *Myrica*

a. Leaves deeply and pinnately lobed; bracts at base of the ovary 8, elongate and forming a bur-like fruit. 2. *Comptonia*

1. MYRICA L.

a. Leaves dull on both sides; nutlets small, with 2 wing-like bracts; flowers at the ends of last year's branches, appearing before the leaves (Fig. 60, b). 1. *M. Gale*

a. Leaves glossy above; nutlets orbicular, covered with a white wax, 2.5-3 mm in diam.; flowers on the current year's wood, appearing after the leaves. (Fig. 60, c). 2. *M. pensylvanica*

1. **M. Gale** L. Fig. 60, b. Map 235. SWEET GALE

Common throughout; edges of streams, along stillwaters, in old ditches and well-drained swamps, or on heaths.

Var. **subglabra** (Chev.) Fern. has the leaves glabrous or nearly so beneath, instead of pubescent. This is found in the northeastern part of the range of the species; in N.S. a number of more glabrous collections have been made from Annapolis and Lunenburg Co. to Pictou and Antigonish, although none has been seen from the extreme southwest nor from C.B.

Lab. to Alaska south to N.C. and Tenn.; Eurasia.

2. **M. pensylvanica** Loisel. Fig. 60, c. Map 236. BAYBERRY

Abundant in the southwestern counties; found around the coast on headlands, beaches and occasionally in bogs; scattered in the center of the Province on the heavier soils, rarely heavily fruiting. June.

N.C. north to N.S. and Nfld. and locally inland to Ohio.

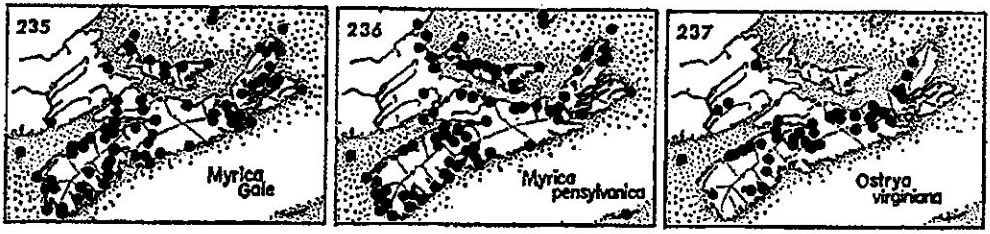
Fig. 60.—Comptonia, (a) fruiting branch x ½. — **Myrica**: (b) *M. Gale* x ½, (c) *M. pensylvanica* x ½.

2. COMPTONIA L'Her

1. **C. peregrina** (L.) Coult. Fig. 60, a. SWEET-FERN

One of the most common ground shrubs over much of the open sandy or barren soils of the Province; a bad weed in wild blueberry fields; abundant on the sands of Kings and Cumberland Co. and throughout the granitic and quartzite areas elsewhere, often associated with pine and wire birch. May. (*Myrica peregrina* (L.) Coult.).

N.S. to Ont. south to Va. and northern Ga.



32. CORYLACEAE HAZEL FAMILY

Trees and shrubs; staminate flowers in long catkins, with 2-10 stamens; pistillate flowers in long catkins or several from a scaly bud, forming small nutlets (often winged) or a single enclosed nut.

a. Bark of older twigs and trunk without elongated lenticels and not peeling readily; leaves softly pubescent beneath; nut or nutlets not winged, enclosed in a papery or leathery involucre.
  b. Shrub, wiry and stoloniferous; pistillate flowers minute and one to several from the bud in early spring, the mature fruits one or two, to 1 cm thick and the involucre with a long beak; leaves with 5-8 pairs of veins, doubly serrate; hazelnut (Fig. 62, d). 1. *Corylus*
  b. Tree, small and not stoloniferous; flowers and fruit in hanging catkins, the nutlets enclosed in bladdery sacs like a bunch of hops; leaves with 9 or more pairs of veins, rather evenly serrate, (Fig. 62, c); staminate catkins abruptly reflexed in fall and winter. 2. *Ostrya*
a. Bark of older twigs with conspicuous elongated lenticels, rather easily peeling off, or not peeling off and the plants low wiry shrubs; nutlets small, exposed in the axils of the scales of the catkin or spike; alders and birches.
  c. Scales of the pistillate catkins thin and papery, soon falling, usually 3-lobed; bark of taller shrubs and trees whitish to yellowish, often peeling; birches (Fig. 61); stamens 2; fruit with thin wings. 3. *Betula*
  c. Scales of the pistillate catkins woody, 3-5-lobed at the tip and long-persistent; stamens 4; nutlets with thick wings (Fig. 62, a, b); alders. 4. *Alnus*

1. CORYLUS L. HAZEL

1. **C. cornuta** Marsh. Fig. 62, d. HAZELNUT

Dry and open woods, generally distributed and often abundant as an understory shrub. In northern C.B. it is found in the climax forest; and

it is likewise common under pines in the Annapolis Valley. It is scattered in roadside thickets, along edges of fields or margins of woods.

Nfld. to B.C. south to Ga. and Colo.

2. OSTRYA Scop. HOP-HORNBEAM

1. O. virginiana (Mill.) K.Koch Fig. 62, c. Map 237
Hop-Hornbeam

Scattered from Annapolis Co. to C.B., often seen in the center of the Province, growing along the intervales and in alluvial soil; very rare elsewhere, especially so in the acidic areas and the southwestern counties. Plants which bear stalked glands on the new branchlets are known as forma **glandulosa** (Spach) Macbr.

N.S. to Man. south to Fla. and Tex.

3. BETULA L. BIRCH

Three series of birches occur in the Province: yellow birch is one; the white birch and its relatives form a second; and the third comprises our dwarf birches which are often only 1-2 m high or less (Boivin, 1967-b)

a. Leaves with 9-11 pairs of veins; pistillate catkins oval, 2-3 cm long, sessile, the bracts persistent; staminate catkins stout, several in a group; wing of fruit narrower than the body; bark yellowish (Fig. 61, c). 1. *B. alleghaniensis*

a. Leaves with 7 or fewer prominent veins; pistillate catkins cylindrical, distinctly stalked in the larger forms, the bracts readily falling away.

b. Erect trees or coarse shrubs; wing of fruit as broad or broader than the body; leaves mostly over 5 cm long, ovate or acuminate at the tip.

c. Leaves wide, ovate to deltoid in shape with long acuminate tips, glabrous except occasionally in the axils of the veins beneath; staminate catkins usually single; young branchlets glabrous.

d. Bark chalky- or ash-white, not flaking off in layers; twigs slender and wiry; staminate catkins mostly borne singly; bracts of pistillate catkins 1.5-4 mm long; native (Fig. 61, a). 2. *B. populifolia*

d. Bark lustrous, cream to pinkish-white, often flaking off in thin layers.

e. Introduced tree with much the aspect of *B. populifolia*; branchlets pendulous. 3. *B. pendula*

e. Native hybrids between *B. populifolia* and *B. cordifolia* with the leaf-shape varying and intermediate between them, much more acuminate than in our common white birch; bracts of pistillate spikes 5-7 mm long; staminate catkins often borne singly; scattered and rare. 4. X *B. caerulea-grandis*

c. Leaves ovate, acute but not long-acuminate, pubescent beneath, at least when young; staminate catkins 2-several.

f. Trees; wings of fruit usually much broader than the body; bark exfoliating, white to brownish.

g. Buds very resinous; leaves rather small, acute, 2-5 cm long; fertile catkins up to 3 cm long; introduced tree; rare. 5. *B. alba*

g. Buds scarcely resinous; leaves acute to mostly short-acuminate, 3-10 cm long (Fig. 61, b); fertile catkins up to 6.5 cm long; common native trees.

h. Leaves ovate to widely lanceolate, tapering to truncate at the base; bracts of fruiting catkins with sub-quadrangular or sub-rhomboidal side-lobes, the median lobe tapering to the tip; young twigs pubescent. 6. *B. papyrifera*

h. Leaves cordate at the base and wider; bracts of fertile catkins erect with smooth curving outer margins, the median lobe long with parallel sides and rounded at the tip; young twigs glabrous. 7. *B. cordifolia*

f. Shrubs of northern C.B.; wings of fruit barely as wide as the body; bark dark, not exfoliating; twigs puberulent; leaves ovate, rather bluntly double-serrate. 8. *B. occidentalis*

b. Low much-branched shrubs with dark close bark; leaves round to slightly elliptical, rounded at the tip, mostly 0.5-2.5 cm long.

i. Leaves round to elliptical, 1-2.5 cm long, short-petioled; bracts of pistillate scales 3-lobed; nutlets definitely winged.

j. Young twigs and undersides of the leaves coarsely pubescent; leaves whitish beneath; twigs without glands. 9. *B. pumila*

j. Young twigs finely pubescent with numerous conspicuous warty glands. 10. *B. glandulosa*

i. Leaves fan-shaped, essentially sessile, about 0.5 cm long, with deep rounded teeth; bracts of pistillate scales unlobed; nutlets wingless; shrub less than 1 m high. 11. *B. Michauxii*

1. **B. alleghaniensis** Britt. Fig. 61, c. YELLOW BIRCH

Throughout; scattered in the southwestern counties and common to dominant in the deciduous forests eastward (see Dansereau and Pageau, 1966). Yellow birch is found on a variety of soils from moist lowlands to drier mountain slopes. In C.B. it extends upward to an elevation of about 1100 feet, beyond the range of sugar maple. This species has been severely affected by disease. 2n = 84 in our area. (*B. lutea* Michx. f.).

Var. **macrolepis** Fern. (Brayshaw, 1966-a) is described as having the scales of the pistillate catkins 8-13 mm long, instead of 5-8 as in the typical variety; and with the wedge-shaped basal portion 2.5-6 mm long instead of 1-2.5 mm. This variety may be more common northwards; it does not seem to be general in N.S. Fernald records it from Comeauville in Digby Co., Argyle in Yarmouth Co. and from Armdale in Halifax Co. Of our collections, one specimen from C.B. approaches this variety, the rest have rather small scales.

Southern Nfld. and Gaspé to se. Man. south in the mts. to Ga., around the Great Lakes and in Wisc. and Minn.

2. **B. populifolia** Marsh. Fig. 61, a. WIRE or GRAY BIRCH

Very common in western and central N.S. on light soils, in pastures, barrens and burnt-over land, where it is a characteristic shrub in the early stages of succession in pastures and barrens. Eastward it becomes replaced by *B. papyrifera* and is known on the mainland only to Monastery in Antigonish Co.; in C.B. only three small locations are known in Richmond and Cape Breton Co.

N.S. to Rimouski west to Ont. and south to Del.