

VEGETATION AND FLORA  
OF THE  
WEST COAST TRAIL,  
PHASE III OF PACIFIC RIM NATIONAL PARK

by

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## ABSTRACT

The vegetation of the West Coast Trail (Phase III) of Pacific Rim National Park has been described and mapped according to a classification **system** consisting of 23 vegetation types, or plant communities. This system is based on vegetation form and dominant species **as** they relate to the physical environment, particularly land forms, topography, **drainage** patterns, soils and proximity to the coastline environment. The system is hierarchal having three levels: the zone, **subzone** and vegetation type. This allows integration and use of the information at different levels of generalization. Field mapping of the vegetation was done at a scale of **1:12,500** and later transferred to the final maps with a scale of **1:25,000**.

At the first level of generalization, two zones are identified: the Coastal Zone and the Interior Zone. The Coastal Zone is composed of vegetation types which are strongly influenced by their close proximity to the **sea**. Although the Coastal Zone occupies far less **area** than the Interior Zone, it has greater vegetation diversity (**12** vegetation types **as** compared to **8**) due to a corresponding diversity in the physical environment. Seven of the **coastal** types are non-forested due to extremes in moisture conditions, active geomorphic processes and ocean spray. Sitka spruce is the dominant tree species in the Coastal Zone primarily because of its tolerance to wind-borne ocean spray.

The Interior Zone is, for the most part, densely forested with western **redcedar** and western hemlock being the dominant tree species. Surface drainage, which is controlled by both topography and parent material, is the single most important factor in determining the pattern

of vegetation types. Western **redcedar** is by far the most common tree species dominating the **vegetation** on extensive moderate to poorly drained **sites**. Western hemlock along with amabilis fir are the leading species on well-drained sites, while shore pine is common in poorly drained bog communities.

Three vegetation types have been described on the basis of land-use **history**. Areas once occupied by Indians (shell **middens**) and logging activities account for most of the land area in these "disturbed types".

Intensive sampling of the vegetation types as well as intervening ecotones and specialized habitats has resulted in a collection of 291 species of vascular plants. Only seven of these are **ornamentals** introduced by man and restricted to sites of former or current human habitation. The remaining species are either indigenous or introduced plants that **are typically** widespread in the **coastal region**. Greatest **species diversity** occurs in **areas** formerly occupied by man such as shell middens and abandoned homesteads, **as well as** certain natural habitats **such as** those along the coastal rocky headlands and in the interior bogs and bog forests.

As the West Coast Trail presents environments similar to those of Phases I and II, it is not surprising that most of the plant species collected in this study have previously been found in one or both of the other two **areas** of the Park. **However**, a total of 55 species collected in Phase III are new additions to the flora of Pacific Rim National Park. Information on species distribution and habitat **as well as** their occurrence in the various vegetation types is provided in this report.

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Miss Glenda Mathew drafted the vegetation maps and designed the cover. Miss Meg Gallup also did some of the drafting while Mrs. Janet Cordes colored the final maps. Mrs. Mildred Hartwell helped organize the final report and typed the manuscript.

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## CHAPTER I

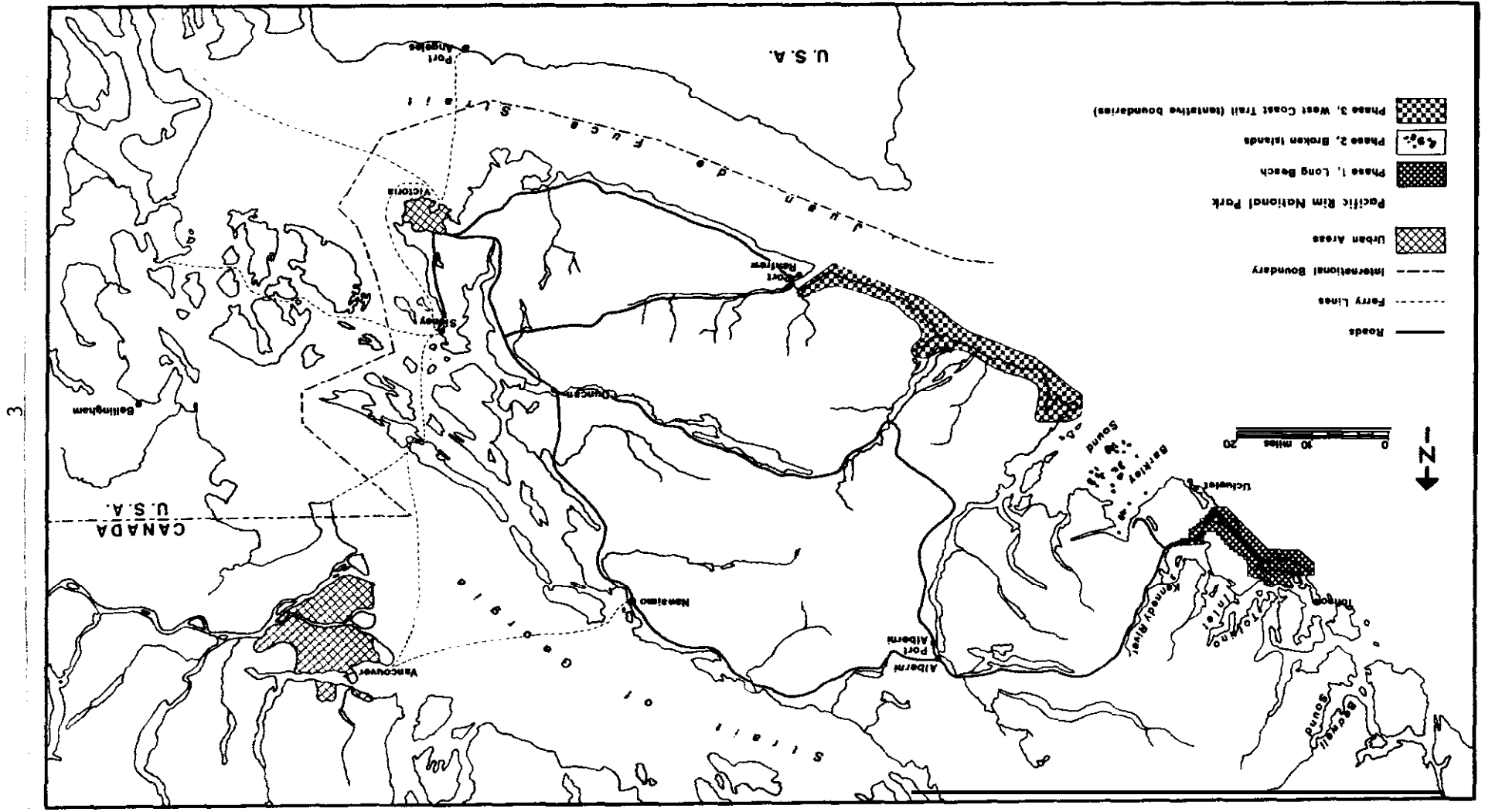
## INTRODUCTION

Pacific Rim National Park was established on April 28, 1970 by an agreement between the Province of British Columbia and the Government of Canada. The Park is **located** on the west coast of Vancouver Island and is made up of three separate areas, or phases: Phase I, Long Beach, the most northerly unit; Phase II, the Broken Group Islands in Barkley Sound; and Phase III, the West Coast Trail, the most southerly unit (Figure 2).

The primary objectives of this project were to describe and map the vegetation of the West Coast Trail (Phase III), and to produce an annotated checklist of the vascular plants found in this area. This work follows similar projects by Bell (1972) for Phase I and Bell and Harcombe (1973) for Phase II. Therefore, this report marks the **completion** of the initial vegetation and vascular plant inventory of **Pacific Rim National Park**, with the exception of the Nitinat triangle section of Phase III which was added to the Park by a recent boundary change (Figure 3).

In order to describe and map the vegetation, it was necessary to devise a **classification** scheme. The system developed is based on vegetation form and dominant species as they relate to the physical environment; particularly Land forms, topography, drainage patterns and soils. Although the vegetation map (located inside of back cover) is only a first approximation, we hope that it will prove to be both useful and flexible. It can be related to geomorphic and other maps for comparison and study purposes. The system additionally provides an overall framework which can be used for inventorying other Park natural resources such as wildlife. It can also be used in Park **planning** and in **interpretation** programs.

Figure 2. The south part of Vancouver Island and adjoining areas showing the location of Pacific Rim National Park. National Park.



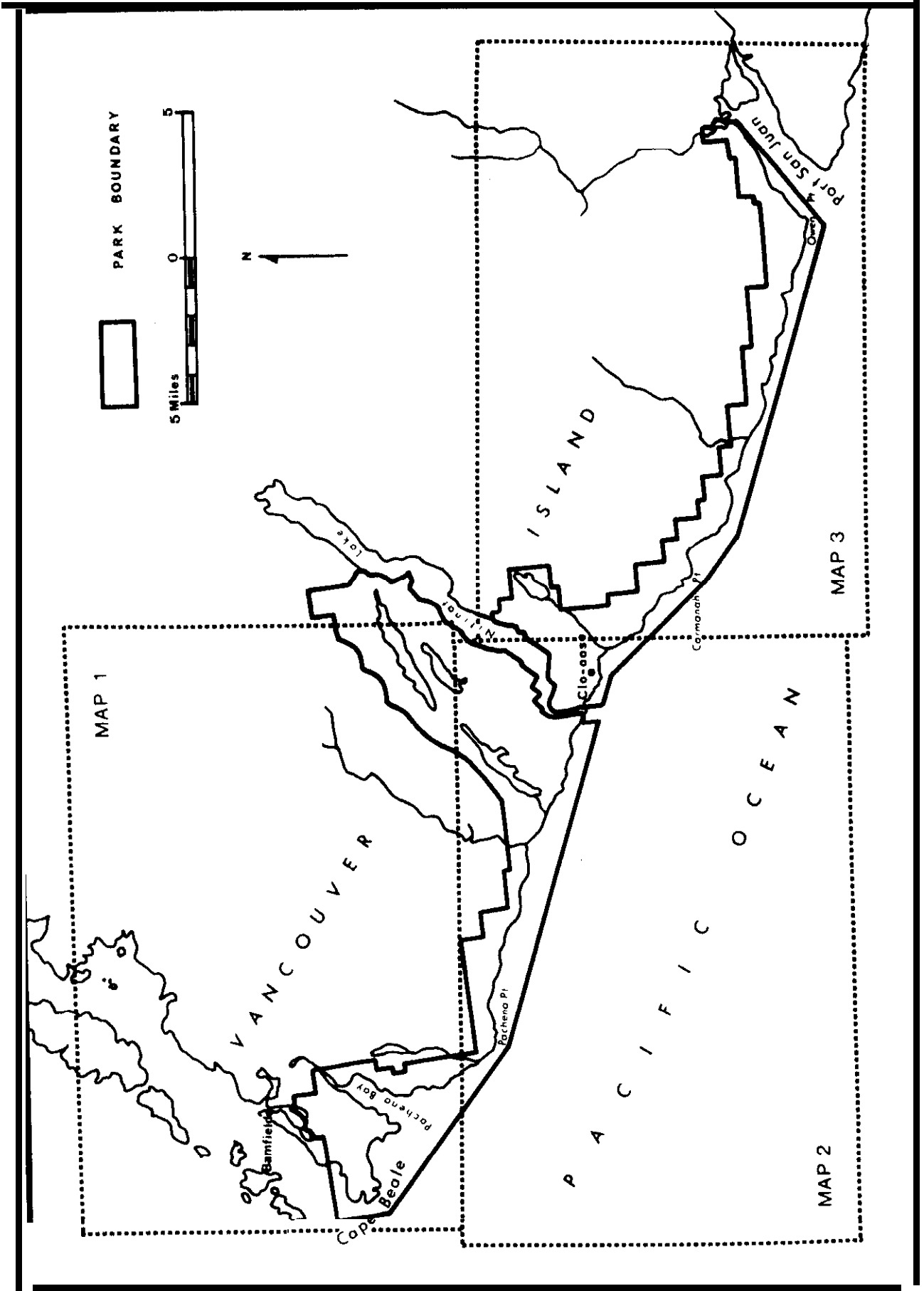


Figure 3. Index for the vegetation maps.

The annotated checklist of vascular plants presents the following information on all species found within Phase III: scientific and common names; notations on abundance, distribution and specific locations; habitat preferences and presence in the various vegetation types; comparisons with the flora of Phases I and II; as well as additional comments such as rarity and taxonomic problems.

This project has been funded by National and Historic Parks Branch Research Contract Number WR 15-73, held by the senior author. Terms of reference for this contract are presented in Appendix I.

## CHAPTER II

## DESCRIPTION OF THE AREA

## PHYSIOGRAPHY

The West Coast Trail phase of Pacific Rim National Park occupies the west coast of Vancouver Island between Barkley Sound and Port San Juan. It is approximately 40 miles in length and averages about one mile in width with the exception of the Cape Beale area and the Nitinat triangle where the width is considerably greater (Figure 3). Approximately 60 miles of coastline is included within Phase III.

Most of the Land surface within Phase III lies between 100 and 300 feet above sea level and is characterized by low relief. The coastline is the major exception to this rule: here the Land often rises abruptly from the sea to an elevation of 100 feet or more. The highest Land in Pacific Rim National Park occurs in the Nitinat triangle area where a large ridge reaches an elevation of approximately 2700 feet.

Very little is known about the geology and geomorphology of the area and the following description is based on some very general observations. Much of the coastline in Phase III is rocky with flat-lying beds of sandstone predominating throughout the area, except in the northwest end of the Park. In the Cape Beale area the main rock types are diorite and gabbro along with what appears to be andesite volcanics. The major landforms in these rock outcrop areas are wave-cut benches and sea cliffs. Cliffs rising 50 to 100 feet above the wave-cut benches are almost continuous along parts of the coastline, particularly in the middle and southern sections.

Beaches are common in Phase III and are of two basic types: narrow sand or shingle beaches that form along the storm Line on top of the wave-cut rock benches, and much wider sand beaches of the Larger bays such as Pachena, Keeha and Garmanah<sup>1</sup>. Inland from the beaches of the Latter type, one finds low-lying, flat or gently undulating Land which has been termed "beach plain". The major Locations for this type of land form arc inland from Keeha Bay on Cape Beale and in the Cheewhat River valley. The beach plain is believed to have been formed since the last major glaciation by infilling of elongated bays or estuaries with beach sand and tidal flat deposits. Kichha Lake and Cheewhat Lake are fresh-water remnants of these former bays'.

Beginning directly behind the present beaches or on top of the sandstone outcrops is a broad, undulating surface which extends over most of Phase III. This land form is referred to as a coastal plain in this study and is believed to be an extension of the Estevan Coastal Plain which is much more prominent further north such as in the Long Beach area. The coastal plain is, for the most part, 100 to 200 feet above sea level and relatively flat or gently sloping towards the coast Line. The surface of the plain is 75 feet or more in height where it approaches the coast-line. Here, it either ends on top of a sea cliff or, where cliffs are lacking) it forms a steep heavily forested scarp which drops to the elevation of the beach.

Very Little is known about the geomorphic history of composition of the coastal plain. Study of this feature was severely limited by an almost complete Lack of exposures. However, by using morphological features of the Land surface to make comparisons with the work by Nelson

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<sup>1</sup> See vegetation map inside of back cover for locations of place names used in the text.

<sup>2</sup> See Cordes, 1972 for a more thorough discussion of coastline progradation.



and Cordes (1972), and Cordes (1972), on the Estevan Coastal Plain in the vicinity of Long Beach, some general, rather speculative statements can be made.

The coastal plain is almost certainly Pleistocene in age and was probably formed during the last major glaciation, most likely the Vashon of approximately 18,000 B.P. or possibly the Less extensive Sumas of approximately 11,000 B.P. (see Halstead, 1968; Mullineaux, 1965). The area between Pachena Bay and Tsusiat River appears to be primarily glacial outwash or "ablation till" which was deposited in a shallow water body. The outwash is extremely variable consisting of inter-bedded gravel, sand and clay. This outwash overlies a compacted blue-gray clay which is similar to material interpreted to be marine till by Nelson and Cordes.

From Tsusiat River south to Port San Juan, the coastal plain has a somewhat more irregular surface morphology with lineations, features more often associated with glacial till rather than the type of outwash deposits found in the Estevan Coastal Plain. This area is also distinguished from the outwash deposits in that it slopes more steeply in the direction of the coast and, therefore, the surface drainage conditions are somewhat better.

#### CLIMATE

The west coast climate is typified by a lack of temperature extremes and an abundance of precipitation. At Bamfield, the mean annual temperature is 49° F while the mean temperature for the warmest month is 56° F and for the coolest month, 40° F. Precipitation is heavy with an annual mean of 107 inches. The major portion of this occurs during the late fall, winter and early spring. There is a sharp drop in precipitation during the summer reaching a low of approximately two inches for the month of August. However, measurable precipitation can still be expected on about one-third of the days during the summer months. Mean annual snowfall is only ten inches.

Due to the high precipitation, moderate temperature and close proximity to the ocean, the humidity remains high throughout the year. The relative humidity seldom falls below 70 per cent and is consistently between 75 and 95 per cent (Cordes, 1972). Fog is frequent during the summer lasting from early morning to early afternoon. These fogs are usually restricted to the immediate coast. Winds are moderate with a mean speed of seven to ten m.p.h. but occasionally reach gale force, especially during the winter storms. The prevailing wind directions are southeast during the winter and northwest and south during the summer.

According to Cordes (1972) wind-borne ocean spray is an important, part of the climate in the immediate vicinity of the coastline. His studies indicate that incoming ocean spray is highest during the fall and winter when major storms are frequent in the north Pacific Ocean. However, the effects of ocean spray on vegetation are at a maximum during late spring and early summer when infrequent precipitation allows salts to accumulate on the foliage. Sitka spruce is much more tolerant than either western hemlock or western redcedar resulting in a band of Sitka spruce forest along most of the coastline.

## VEGETATION

The West Coast Trail lies within the wet subzone of the Coastal Western Hemlock Zone (Krajina, 1965; Orloci, 1961). The climatic climax forest on mesic sites in this subzone is dominated by western hemlock (Tsuga heterophylla) and amabilis fir (Abies amabilis). This forest is typically multi-storied being made up of dense, uneven-aged stands. The understory is lush and dense consisting of ericaceous shrubs and ferns. Both the forest floor as well as the trees and other woody plants are covered with a thick mat of mosses and liverworts.

Western redcedar (Thuja plicata) followed by western hemlock are the two most abundant tree species in Phase III. These species form extensive stands on the more inland parts of the Park on sites where drainage is somewhat restricted. Hemlock along with lesser amounts of amabilis fir dominate the better-drained mesic sites. Xeric to submesic sites support western **hemlock**, **western redcedar** and shore pine (Pinus contorta), either singularly or in **combination**. Subhygric and wetter sites are usually dominated **by western redcedar** and, to a lesser extent, by shore pine. western hemlock, western yew (Taxus brevifolia) and western white pine (Pinus monticola). Sitka spruce (Picea sitchensis) is typical of certain specialized habitats such as flood plains, seepage sites and along the coast where it is tolerant to ocean spray.

#### SOIL

Soils of the coastal spruce forest belong to the Podzolic, Regosolic, Gleysolic, and Organic Orders while podzolization, gleization, and mor formation are the dominant pedogenic processes. **A majority of the** soils found on well-drained **sites** have a thick mor humus layer, a well-defined eluviated A horizon and thick podzolic B horizon, and **belong to the** Podzolic Order. Normally there is a very sharp break between the humus layer and the Ae horizon except in seepage sites where a melanized Ah horizon is present on the surface or beneath a layer of raw humus. All three great groups of the Podzolic Order are well represented and, as a group, are far more common than any other order.

Soils belonging to the Regosolic Order occur on rocky sites and sand plains. Lithic Regosols consist of little more than a thick layer of raw humus over bedrock. Even though these soils are classified as regosols, they are mature profiles and show no signs of further pedogenic development.

Orthic Regosols, consisting of mor humus over slightly altered sand, are common on beach plains of fairly recent origin. Given time, these soils develop into podzols.

Soils belonging to the Gleysolic Order form on poor drainage sites such as flat areas and depressions. Gleysols also form on better-drained sites, particularly those with coarse-textured parent material, as a result of iron pan formation leading to a deterioration of internal drainage. It appears as if the process of gleization is more prominent in the interior forest, judging by the more frequent occurrence of gleysols and gleyed podzols. This is undoubtedly related to the presence of extensive flat areas with poor surface drainage.

Organic soils are of limited occurrence in the area, being restricted to very poorly drained sites where the water table remains close to the surface throughout the year.

Sites of early Indian habitation with extensive midden deposits often have chernoemic-like rendzina soils. These sites are gradually invaded by Sitka spruce resulting in a trend towards podzolization and mor humus formation.

## CHAPTFB III

## METHODS

Prior to mapping, a considerable amount of time was spent in the field to gain familiarity with both the vegetation and physical environment. Using this information as well as experience gained from previous work by the authors (see Cordes, 1972; Cordes and MacKenzie, 1972), a preliminary classification system was formulated. Following this, mapping and vegetation sampling proceeded together with the sampling being a more-or-less continuous check on the mapping. In addition, most of the mapping of the coastline area was checked on the ground. The impenetrable nature of the vegetation and lack of trails in the more inland parts of Phase III limited observations to smaller areas where sampling was carried out.

Mapping was done by delimiting differences in vegetation form and dominant species on 1:12,500 scale air photos. This information was later transferred to the final maps with a scale of 1:25,000. These maps are included inside the back cover of this report. Figure 3 shows the area covered by each of the three maps in the set.

In order to describe the vegetation types, or plant communities as they are often termed, 142 plots were selected for use in sampling the vegetation and environment. The procedure used in sampling is as follows: Plots having dimensions of either one by one chain or one by two chains were placed in locations which were judged to be typical of the vegetation type in question. A minimum of five plots were analyzed for each type with the exception of several types which covered very small areas and could be adequately described with less than five plots. Visual estimates of cover as a percentage of the total plot area were made on the tree,

shrub arid herb Layers (Table 1). Species occurring in each layer were recorded and rated according to a species significance scale (Table 2) . Some tree mensuration data as well as observations on the parent material, topography, water table, exposure to the ocean and soils were also recorded<sup>1</sup>.

Synthesis of the most relevant of the sample plot data is presented in table form along with the written descriptions of the vegetation types. The vegetation data has been limited to species which are present in **80%** or more of the plots of a given type (constant species). Plot data not included in this report is on file and available from the senior author.

The annotated checklist of vascular plants was prepared using the sample plot data as well as additional information gathered from many other sites visited during the course of the field work. Many areas not normally included within sample plots were also examined; for example, ecotones between vegetation types and specialized habitats such as stream banks, Lake and estuary shorelines and cliff faces. Voucher specimens for all plant species will be turned over to either the herbarium at the University of Calgary or the herbarium of the British Columbia Provincial Museum, or both.

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<sup>1</sup> Soil classification and terminology follows The System of Soil Classification for Canada (National Soil Survey Committee of Canada, 1970).

Table 1. Vegetation Layers Used in Both the Analysis and Synthesis of the Types.

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Tree layer	<b>A<sub>1</sub></b> - dominant trees
	<b>A<sub>2</sub></b> - co-dominant trees
	<b>A<sub>3</sub></b> - intermediate and suppressed <b>trees</b> over 30 feet in height
Shrub layer	<b>B<sub>1</sub></b> - <b>saplings</b> and shrubs between 6 and 30 feet in height
	<b>B<sub>2</sub></b> - <b>shrubs</b> between 6 inches and 6 feet in height
Herb layer	<b>C</b> - <b>herbaceous</b> plants and shrubs less than 6 inches in height

Table 2. **The** Species Significance Scale Showing the Cover Range for Each Value.

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<u>SPECIES</u>	<u>SIGNIFICANCE</u>	VALUE
Seldom, <b>cover</b> negligible . . . . .		1
Very scattered, cover negligible . . . . .		2
Scattered, cover up to 5% of plot . . . . .		3
Common, cover 5-10% of plot . . . . .		4
Often, cover <b>10-20%</b> of plot . . . . .		5
Very often, cover <b>20-35%</b> of plot . . . . .		6
Abundant, cover 35-50% of plot . . . . .		7
Abundant, cover <b>50-75%</b> of plot . . . . .		8
Abundant, <b>cover 75-95%</b> of plot . . . . .		9
Abundant, cover <b>95-100%</b> of plot . . . . .		10

## CHAPTER IV

## PLANT COMMUNITIES AND THEIR ENVIRONMENTS

INTRODUCTION

It is well understood by plant ecologists that the vegetation of any given site is an expression of the complex of environmental factors acting on that site. It has often been stated that vegetation is the single best integrator of the total environment. In developing the present classification system we have attempted to follow these ideas by considering the physical environment as being inseparable from, and strongly integrated with the vegetation. Therefore, we have considered certain aspects of the physical environment as being important criteria in setting up the classification units and have used them in mapping and in describing the vegetation types, subzones, and zones. Structural elements of the environment that we have found particularly useful are topography, parent material, soil drainage, soil morphology, and spatial position in reference to the coastline. By following this procedure, we feel that the classification system along with the description of the units represents more than simply a vegetation classification; it is a first approximation of a classification and map of the Park's terrestrial ecosystems.

The classification system is hierarchal having three levels, each being more inclusive than the one below it. These are, in order of high to low: the zone, the subzone, and the vegetation type. This system has considerable value in that it allows integration of information at different levels of generalization. The system is also flexible and can be modified either by expanding or contracting individual units or by the addition or subtraction of units at any level. This is important in light of the fact that considerable information has become "outdated" by being tied into a



system which has become obsolete because of its inflexibility or because a better system has been developed.

The vegetation classification should be of considerable value in providing an overall framework which can be used to inventory and classify other kinds of the Park's natural resources. The system undoubtedly has a number of uses in park planning and management, many of which are self-evident. For example, it would be impossible to develop a sound park zoning plan without the input of information made available by a vegetation classification such as this one, as well as inventories of a number of other natural resources.

The Park's interpretation program is another area which can benefit from this classification system. The descriptions of the vegetation types provide information on plant species, structure of the vegetation and characteristics of the environment. This type of information could be used in a program which would emphasize an ecological interpretation of the various ecosystems of the Park. The idea of ecological series could also be incorporated into interpretation programs. The beach strand series from unvegetated sand to climax Sitka spruce forest and its relationship to geomorphic processes and plant succession is a good example. Other larger scale relationships such as those between vegetation types and parent material or drainage could also be useful for interpretation purposes.

#### THE VEGETATION CLASSIFICATION

At the first level of generalization in the classification system, two zones are identified: the Coastal Zone and the Interior Zone (Table 3). The Coastal Zone is composed of vegetation types which are strongly

Table 3. THE CLASSIFICATION SYSTEM

COASTAL ZONE

Rocky Headlands and Islands **Subzone**

- A1 Rock outcrop (**RO**)
- A2 Red fescue herb type (**FrPm**)
- A3 **Salal** shrub type (**GsLi**)
- A4 **Spruce-salal** forest (**PsGsMd**)
- A5 Red cedar-hemlock **scrub** forest (**TpThGs**)

Beaches, Near-Coast Terraces and Plains **Subzone**

- B1** Beach sand (**BS**)
- B2** Beach rye herb type (**Em**)
- B3 Red **alder-salal** shrub type (**ArGs**)
- B4 **Spruce-salal** forest (**PsGsPa**)
- B5 Spruce-sword fern forest (**PsRsPm**)
- B6 Hemlock-spruce forest (**ThPs**)

Tidal Flat **Subzone**

- E1 Tufted hairgrass type (**DcSv**)

INTERIOR ZONE

Coastal Plain **Subzone**

- C1 Hemlock-deer fern forest (**ThBs**)
- C2 Cedar-hemlock forest (**TpTh**)
- C3 Cedar **muskeg** forest (**Tp**)
- C4 Shore pine bog forest (**Pc**)
- C5 Sphagnum bog type (**SpLg**)
- C6 Water lily type (**Np**)

Rock Outcrop **Subzone**

- D1** Hemlock-shore pine scrub forest (**ThPc**)

Riverine **Subzone**

- G1** Spruce-hemlock forest (**PsTh**)

DISTURBED AREAS

- F1** Logged type (**L**)
- F2 Other cleared types (**D**)
- F3 Shell **midden** type (**SM**)

Table 3. (Continued)

## COASTAL ZONE

Vegetation Type	Rocky Headlands and Islands Subzone					Beaches, Near-Coast Terraces and Plains Subzone						Tidal Flat Subzone
	RO	FrPm	GsLi	PsGsMd	TpThGs	BS	Em	ArGs	PsGsPa	PsRsPm	ThPs	DcSv
Mapping Symbol	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	E1
Parent Material	Bedrock					Beach deposits			Beach deposits, glacial outwash			Tidal flat deposits
Drainage Class	Xeric	Subxeric	Submesic	Mesic	Mesic	Subxeric	Submesic	Submesic	Mesic	Subhygric	Subhygric	Subhydric
Wind Exposure	Extreme	Extreme	Very high	Very high	High	Extreme	Extreme	Very high	Very high	High	Moderate	Moderate
Coverage (%)												
Tree layer	.	.	4	54	64			.	41	65	54	
Shrub layer	.	.	76	98	74		.	89	94	78	75	1
Herb layer	.	28	39	11	19		35	22	10	30	28	81
Constant Species												
Trees												
<i>Picea sitchensis</i>				X		.	.		X	X	X	
<i>Tsuga heterophylla</i>					X	.	.			X	X	
<i>Thuja plicata</i>					X	.	.			.	.	
<i>Alnus rubra</i>						.	.			X	.	
Shrubs												
<i>Gaultheria shallon</i>			X	X	X	.	.	X	X	X	X	.
<i>Lonicera involucrata</i>			X			.	.	X		.	.	.
<i>Rubus spectabilis</i>				X		.	.			X	X	
<i>Vaccinium ovatum</i>					X	.	.			.	.	
<i>Vaccinium parvifolium</i>					X	.	.	.		.	X	
<i>Alnus rubra</i>						.	.	X		.	.	
<i>Menziesia ferruginea</i>						.	.	.		.	X	
<i>Rosa nutkana</i>						.	.	X		.	.	
Herbs												
<i>Fragaria chiloensis</i>	X			.	.	.	.					
<i>Hypochaeris radicata</i>	X			.	.	.	.					
<i>Festuca rubra</i>	X			.	.	.	.					
<i>Castilleja miniata</i>	X			.	.	.	.					
<i>Pteridium aquilinum</i>		X		.	.	.	.	X	X			
<i>Maianthemum dilatatum</i>		X	X	.	.	.	.				X	
<i>Blechnum spicant</i>				.	X	.	.		X	X	X	
<i>Elymus mollis</i>				.	.	.	X					
<i>Carex macrocephala</i>				.	.	.	X					
<i>Lathyrus japonicus</i>				.	.	.	X					
<i>Hooker's peplodes</i>				.	.	.	X					
<i>Vicia gigantea</i>				.	.	.	.	X				
<i>Polystichum munitum</i>				.	.	.	.			X		
<i>Athyrium filix-femina</i>				.	.	.	.			X		
<i>Tiarella trifoliata</i>				.	.	.	.				X	
<i>Deschampsia caespitosa</i>				.	.	.	.					X
<i>Distichlis spicata</i>				.	.	.	.					X
<i>Hordeum brachyantherum</i>				.	.	.	.					X

RO: Rock outcrop  
 FrPm: Red fescue herb type  
 GsLi: Salal shrub type  
 PsGsMd: Spruce-salal forest  
 TPThGs: Red cedar-hemlock scrub forest

BS: Beach sand  
 Em: Beach rye herb type  
 ArGs: Red alder-salal shrub type

PsGsPa: Spruce-salal forest  
 PsRsPm: Spruce-sword fern forest  
 ThPs: Hemlock-spruce forest  
 DcSv: Tufted hairgrass type

Table 3. (Continued)

	INTERIOR ZONE						ThPc	PsTh
	Coastal Plains Subzone			Rock Outcrop Subzone				
Vegetation Type	ThBs	IpTh	Ip	Pc	Splg	Np		
Mapping Symbol	C1	C2	C3	C4	C5	C6	D1	G1
Parent Material	Glacial outwash, Glacial till						Rock outcrop, Till	Alluvial Deposits
Drainage Class	Mesic	Subhygric	Hygric	Subhygric	Subhygric	Hydric	Mesic	Subhygric
Wind Exposure	Moderate	Moderate	Low	Low	Very low	Very low	Moderate	Low
Coverage (%)								
Tree layer	66	41	46	24	.	.	42	57
Shrub layer	59	74	73	50	57	.	66	61
Herb layer	31	29	29	70	80	37	28	43
Constant Species								
Trees								
Abies amabilis	X	.	.	.	.	.	.	.
Tsuga heterophylla	X	X	X	.	.	.	X	X
Thuja plicata	.	X	X	X	.	.	X	.
Pinus contorta	.	.	.	X	.	.	X	.
Picea sitchensis	.	.	.	.	.	.	.	X
Shrubs								
Menziesia ferruginea	X	X	X	.	.	.	.	.
Vaccinium parvifolium	X	X	X	.	.	.	X	.
Gaultheria shallon	X	X	X	.	.	.	X	X
Kalmia polifolia	.	.	.	.	X	.	.	.
Ledum groenlandicum	.	.	.	.	X	.	.	.
Rubus spectabilis	.	.	.	.	.	.	.	X
Herbs								
Blechnum spicant	X	X	X	X	.	.	X	X
Maianthemum dilatatum	.	X	X	.	.	.	X	X
Lysichitum americanum	.	.	X	.	.	.	.	.
Empetrum nigrum	.	.	.	X	.	.	.	.
Linnaea borealis	.	.	.	X	.	.	.	.
Cornus unalaschensis	.	.	.	X	.	.	.	.
Drosera rotundifolia	.	.	.	X	X	.	.	.
Vaccinium oxycoccus	.	.	.	X	X	.	.	.
Carex obnupta	.	.	.	X	X	.	.	.
Scirpus cespitosus	.	.	.	.	X	.	.	.
Sanguisorba officinalis	.	.	.	.	X	.	.	.
Rhynchospora alba	.	.	.	.	X	.	.	.
Coptis asplenifolia	.	.	.	.	X	.	.	.
Gentia douglasiana	.	.	.	.	X	.	.	.
Nuphar polysepaium	.	.	.	.	.	X	.	.
Menyanthes trifoliata	.	.	.	.	.	X	.	.
Polystichum munitum	.	.	.	.	.	.	.	X
Tiarella trifoliata	.	.	.	.	.	.	.	X

ThBs: Hemlock-deer fern forest

IpTh: Cedar-hemlock forest

Ip: Cedar muskeg forest

Pc: Shore pine bog forest

Splg: Sphagnum bog type

Np: Water lily type

ThPc: Hemlock-shore pine scrub forest

PsTh: Spruce-hemlock forest

influenced by their close proximity to the sea. **The Interior Zone** consists of types that are located inland from the Coastal Zone and have developed primarily in response to edaphic influences such as differences in parent material and drainage.

The most obvious differences between the two Zones, vegetation aside, are the more severe climate and better drainage of the Coastal Zone. Ocean spray, high winds and associated storm waves are characteristic of the coastal climate. The Coastal Zone is also differentiated by the much more dynamic geomorphic processes, especially along the strand and on beach plains and dune areas.

## I. THE COASTAL ZONE

The Coastal Zone is divided into three major subzones: the Rocky Head Lands and Islands Subzone, the Beaches and Near-Coast Marine Terrace Subzone, and the Tidal Flat Subzone. The first two of these subzones are differentiated on the basis of their distinctive parent materials: the first is found on sandstone bedrock, while the second occurs on beach sand and other transported surficial deposits. The Tidal Flat Subzone includes estuaries and salt marshes.

### A. The Rocky Headlands and Islands Subzone

This subzone consists of five vegetation types, their spatial distribution being closely related to distance and degree of exposure to the ocean and to the thickness of humus accumulation on the ever-present bedrock. These types are: the rock outcrop type, the red fescue herb type, the salal shrub type, the spruce-salal forest type, and the redcedar-hemlock scrub forest type.

Table 4. Species Significance Values for Constant Species in the Vegetation Types of the Rocky Headlands and Islands Subzone

STRATA		A <sub>2</sub> RED FESCUE HERB TYPE	A <sub>3</sub> SALAL SHRUB TYPE	A <sub>4</sub> SPRUCE-SALAL FOREST	A <sub>5</sub> RED CEDAR-HEMLOCK SCRUB FOREST
A <sub>1</sub>	<i>Picea sitchensis</i>	-		6.2	
A <sub>2</sub>	<i>Picea sitchensis</i>	-		4.3	
	<i>Tsuga heterophylla</i>	-		-	2.3
	<i>Thuja plicata</i>	-		-	3.0
A <sub>3</sub>	<i>Picea sitchensis</i>	-		2.9	
	<i>Tsuga heterophylla</i>	-		-	2.3
	<i>Thuja plicata</i>	-		-	2.9
B <sub>1</sub>	<i>Gaultheria shallon</i>	-		6.1	3.4
B <sub>2</sub>	<i>Lonicera involucrata</i>	-	3.4	-	
	<i>Rubus spectabilis</i>	-		2.9	
	<i>Gaultheria shallon</i>	-	6.1	8.6	5.1
	<i>Vaccinium ovatum</i>	-		-	3.6
	<i>Vaccinium parvifolium</i>	-		-	2.1
C	<i>Fragaria chiloensis</i>	2.2		-	
	<i>Hypochasris radicata</i>	1.7		-	
	<i>Festuca rubra</i>	1.5		-	
	<i>Castilleja miniata</i>	1.3		-	
	<i>Picea sitchensis</i>	1.4		-	
	<i>Pteridium aquilinum</i>		4.0	-	
	<i>Maianthemum dilatatum</i>		2.3	2.8	
	<i>Blechnum spicant</i>			-	3.7

In a large portion of the West Coast Trail section of the Park, the immediate coast consists of sandstone and andisite rock outcrops. In most places this rock is in contact, with the sea, although a narrow beach is occasionally present. The land may slope right to the sea, or end abruptly in a sea cliff with heights varying from approximately five to sixty feet. The spruce-salal forest type and the redcedar-hemlock scrub forest type are found growing right to the edges of these cliffs. On sloping land the spruce-salal type may extend almost to the winter storm highwater mark. The redcedar-hemlock type, however, is not found on exposed sloping land because the dominant species are intolerant to ocean spray. The rock outcrop type, the red fescue herb type, and the salal shrub type are found seaward of the forest types on sea cliffs, sloping land, stacks and islets.

A<sub>1</sub> The rock outcrop type (RO)

The most seaward of the types in the Rocky Headlands and Islands Subzone is composed of the unvegetated rock shelves, steep cliffs and stack faces on the immediate coast. These areas are subject to the most extreme effects of wind, ocean spray and tidal action, and many of them are, indeed, sub- or intertidal in nature. Due to these severe environmental influences, no soil development is possible, and there is essentially no habitat for terrestrial vascular plant growth.

Eelgrass (Zostera marina), and the surfgrasses (Phyllospadix scouleri, P. torreyi), are able to grow in the more sheltered tide pools and surge channels. Rather extensive beds of eelgrass may develop where networks of tide pools are formed on protected rock shelves. The most notable of these are on Cape Beale: on the headlands at both ends of Keeha Bay, and on the Lawton Point headlands of Topaltas Bay. Other good examples in the Park are

Figure 4. The rock outcrop type: an algae-covered rock bench near Michigan Creek.

Figure 5. The red fescue herb type near the lighthouse on Cape Beale.



found along Seven Mile Beach and on the rock shelf north of the Klanawa River. The wealth of marine life associated with these tide pools, as well as the spectacular rock arch formations, make these areas particularly attractive. However, there is danger that they may suffer from intensive collecting by campers and hikers. Lawton Point, the most accessible of these two areas, is already showing the effects of such activities.

The trail descends onto the rock outcrop type for approximately a mile north of the Klanawa River, and for several miles between Camper Day and Thrasher Cove. In these areas the growth of non-vascular plants is particularly apparent; black crustose lichens such as Verrucaria sp. cover many of the rocks, two species of Fucus (rock kelp), and other kelp-like algae are exposed during Low tides, and Macrocystis grows offshore in the deeper surge channels. While hikers are able to make rapid progress along these areas, they can be very dangerous during rain and fog due to the slipperiness of the rocks.

#### A<sub>2</sub> The red fescue herb type (FrPm)

The red fescue herb type occurs in a narrow area on the upper reaches of the rock shelves just below the shrub fringe or forest margin. In these areas protection from wind and tide action is such that soil development can occur where the microtopography of the rock allows accumulation of sand and organic debris. As a result, many areas of this type are very small and were impossible to map at the scale employed.

As was discovered in the vegetation studies of Phases I and II, rock herb communities are extremely diverse in composition (Bell, 1972; Bell and Harcombe, 1973). This is reflected by plant Lists for the type which indicate the occurrence of a large number of species, few of which

appear consistently. There is, however, a general trend in species composition depending on degree of exposure and extent of soil development.

In the Lowest,, most exposed areas, Plantago maritima (marine plantain) and Potentilla villosa (wooly cinquefoil) occur as scattered individuals growing in sand which has accumulated in crevices in the rocks. The organic content of this soil is Low while salinity is high due to ocean spray and wave action.

At slightly higher and more protected Levels, as on the inland side of stacks or above the zone of heavy surf spray, Fragaria chilensis (beach strawberry), Allium cernuum (nodding onion), Castilleja miniata (Indian paintbrush), and grasses such as Festuca rubra (red fescue), Hordeum brachyantherum (meadow barley), and Deschampsia cespitosa (tufted hairgrass) are common. Vegetation is still not continuous, being limited to soil accumulations in rock crevices and depressions. Mimulus guttatus (yellow monkey flower), Prunella vulgaris (self-heal), Sisyrinchium spp. (blue and yellow-eyed grasses), and Montia parvifolia are sometimes found at seepage sites, or in depressions where fresh water is trapped.

The most continuous vegetation cover is found on the very upper reaches of the rock shelves and on the summits of offshore stacks where flat, protected areas often occur. Here most of the previously mentioned mid-level species are common, along with various others such as Anaphalis margaritacea (pearly everlasting), Achillea millefolium (yarrow), Hypochaeris radicata (cat's ear), and Epilobium watsonii (willowherb). Bearberry (Arctostaphylos uva-ursi) often forms almost continuous mats on the summits of stacks. Shrubs such as Lonicera involucrata (black twinberry), Rosa nutkana (Nootka rose), Ribes divaricatum (gooseberry) and Amelanchier

alnifolia (saskatoon) may become established in the deeper soil pockets, and even Sitka spruce may occasionally advance into this type in the wind shadow of logs or stone outcrops.

Distinctive subcommunities within this type occur in specific habitats. Seepage cliffs which are well protected from ocean spray are often covered with Adiantum pedatum (maidenhair fern). Aruncus sylvestris (goatsbeard) is frequently present as well while Montia parvifolia often produces extensive stoloniferous growth over the moss-covered rocks. Leathery polypody (Polypodium scoleri) is very tolerant to ocean spray, allowing it to exist on exposed rock faces. Large depressions on flat-topped benches sometimes contain fairly deep pools of fresh water with stands of Juncus effusus (common rush) and Juncus subiniformis (hair-leaved rush). On the most protected cliffs wild columbine (Aquilegia formosa) is an infrequent but spectacular species .

Since the rock herb community is so limited in extent, and occurs on such precipitous terrain, many sites are subjected to little human activity. The hiker is most likely to come into contact with this type at Flat Rocks, and in areas where the trail descends onto the rock shelf, as mentioned in the previous section.

### A<sub>3</sub> The salal shrub type (GsLi)

Inland from the red fescue herb type a thin, dense band of shrub is usually found. This band is continuous along the coast in some places, but more often occurs as discontinuous small clumps which were impossible to map at the scale employed. The accumulation of a continuous mor humus layer over bedrock, the result of decomposition of past vegetation, has allowed the development of this shrub fringe on sites where some factor, or

combination of factors, prevents the establishment of substantial tree growth. The fact that the upper branches of the shrubs have often been killed due to the effects of ocean spray suggests that exposure may be a controlling agent. However, the inability of Sitka spruce seedlings to compete with the very dense shrub growth is probably a better explanation.

The shrub fringe is usually dense to the point of being impenetrable. A scattered layer of stunted Sitka spruce may be present but never covers more than 25% of the plot. Sitka spruce, along with the occasional western redcedar, generally exhibit the *krummholz* growth form. Taxus brevifolia (western yew), otherwise seen only in the very different environment of the muskeg forest, also occurs in *krummholz* form on the drier, south-facing sites. Pacific crab (Pyrus fusca) may be abundant in the tall shrub layer, or as stunted individuals in the lower shrub layer.

The shrub layers are dominated by salal (Gaultheria shallon), and black twinberry (Lonicera involucrata). Lonicera may reach heights of fifteen feet, while salal is predominantly six feet or less in height. Salmonberry (Rubus spectabilis), Nootka rose (Rosa nutkana), and thimbleberry (Rubus parviflorus) are also common but far less consistent in occurrence than the first two species. Gooseberry (Ribes divaricatum) may be abundant in some exposed sites.

Due to the density of the shrub layer, herb growth is often very poor, and limited to the periphery of the type. Exceptions to this occur on the moist, protected inland side of stacks and islets, where cow parsnip (Heracleum lanatum) and sea watch (Angelica lucida) may be common; otherwise bracken (Pteridium aquilinum), wild lily-of-the-valley (Maianthemum dilatatum), and giant vetch (Vicia gigantea) are the only consistent herb species. The tall, vigorous growth of bracken and the climbing growth form of giant vetch

Figure 6. The salal shrub type near the Nitinat narrows. Patches of the red fescue herb type are in the foreground.

Figure 7. The spruce-salal forest type (PsGsMd) on sandstone bedrock near the Nitinat narrows.

allow them to bypass the dense shrub layer and exist under essentially open conditions, while Maianthemum is extremely shade tolerant. Other species fairly common in the more open sites are deer fern (Blechnum spicant), twinflower (Linnaea borealis), and Pacific reedgrass (Calamagrostis nutkaensis).

The most extensive example of this vegetation type can be seen on the rocky headlands and islets near the Cape Beale lighthouse. Since the shrubs are so impenetrable and the shrub fringe so narrow, the trail does not often pass through this type, although it does emerge on several of the more open stands on the cliff tops between Tsusiat Falls and the Nitinat Narrows. Human disturbance in this type is very limited, and it is not easily susceptible to damage. The shrub fringe normally merges into the more extensive spruce-salal forest.

#### A<sub>4</sub> The spruce-salal forest type (PsGsMd)

This type is the dominant forest cover on rocky headlands and islands. It is always found in well-drained topographic locations. Stands of this type usually occur in a strip parallel to the coastline which may be as much as 200 feet in width, although generally it is much thinner. These strips often have a rock outcrop border on their seaward side; the most exposed stands are often isolated by large expanses of bare rock that are at a slightly lower elevation and are subjected to denudation by waves during severe storms.

A typical soil profile consists of a thick layer of felty mor humus over bedrock. This humus is very coarse and has a thick matted fermentation layer with abundant white mycelia. These soils have been classified as Lithic Regosols. In some places a layer of mineral soil may be present on top of the bedrock resulting in soil profiles which belong to the Podzolic Order.

Stands on land which slopes towards the ocean receive *Large* amounts of ocean spray and the trees are often very stunted, taking on a *hedgelike* or *krummholz* appearance. These wind-sculpted spruce are one of the unique characteristics of the rocky coastline and one of the most interesting features in the Park. The spruce here have a straight bole with very large branches that are often somewhat longer on the seaward side. Such branches are few in number and located on the upper half or third of the tree. The rest of the bole is bare, or, more commonly, covered with the stubs of broken branches and the occasional dead branch, indicating that branches usually die and are then broken by the wind, rather than broken when alive. Light conditions are always good within the canopy, leading one to suspect ocean spray as the factor responsible for *the* death of these lower branches. Many stands are very old, with trees 300 years and older being common.

The mean coverage value for the tree layer is 54%. This relatively open forest canopy has allowed a very dense shrub layer to develop. Both the high and low shrub layers are dominated by salal which may be as much as ten feet tall. Small sections of the trail located in the spruce-salal forest type force the hiker to become well acquainted with this very dense salal. In addition to the salal, salmonberry and black twinberry are occasionally encountered.

Coverage in the herb layer is limited due to shading from the dense shrub layer. Wild lily-of-the-valley and salal seedlings are the most common species, and in most stands they have negligible cover value. Bracken fern is frequently seen, especially in stands with an open tree canopy. The most common mosses are Burhynchium oregonum, E. praelongum, Isoetecium stoloniferum and Plagiothecium undulatum.

Like the salal shrub fringe, usage of this type is limited due to its impenetrability, and it is not easily susceptible to damage.

A<sub>5</sub> The redcedar-hemlock scrub forest type (TpThGs)

This type is found on topographic locations which are similar to those of the spruce-salal forest type, such as sloping land and cliff tops. However, it only occurs in those locations which are protected and not exposed to intense ocean spray.

Western redcedar and western hemlock (Tsuga heterophylla) are the dominant and co-dominant species in the tree layers. Both these species are much less tolerant to ocean spray than Sitka spruce. (Cordes, 1972). As a result, they form a hedge-like canopy, with the individual trees becoming progressively more stunted and deformed toward the seaward side of the stand. Inland, these trees become taller and less deformed, reaching a height of thirty to forty feet. Width of the stands varies from forty to 100 feet or more. At a point where the canopy reaches its maximum height, the type usually grades into one of the cedar-hemlock forest types (C<sub>2</sub> or C<sub>3</sub>), or the hemlock-shore pine scrub forest (D<sub>1</sub>), depending on the edaphic characteristics of the site in question.

An excellent example of this wind-shaped, or ocean spray-shaped, forest can be seen at the point where the trail to the Cape Beale lighthouse terminates at the narrow tidal channel separating the mainland from the island lighthouse. The trail also passes through small sections of this windswept type on cliff tops which may be up to 100 feet above sea level.

The soils of this type are similar to those of the spruce-salal type and have also been classified as Lithic Regosols. A thick layer of felty mor humus exists over the bedrock, and a thin layer of mineral soil occurs in small depressions.



The forest canopy is moderately dense, with a mean coverage value of 64%. The shrub layers are sufficiently dense to make travel through the type difficult; they have a mean coverage value of 74% and, once again, are dominated by salal and other ericaceous shrubs. Evergreen huckleberry (Vaccinium ovatum) is a common species in both the shrub layers, while red huckleberry (Vaccinium parvifolium) and false azalea (Menziesia ferruginea) are frequently seen in the Low shrub layer, but have negligible cover.

The extensive shading by the tree and shrub layers results in a somewhat sparse herb layer having a mean coverage value of 19%. Deer fern is the dominant and only common species. Wild Lily-of-the-valley is a scattered species having negligible cover, as are seedlings of the ericaceous shrubs. Mosses include Eurhynchium oreganum, Plagiothecium undulatum, Isolothecium stoloniferum, Eurhynchium praelongum and Calypogeia trichomanis.

This forest type is somewhat more susceptible to damage by human activity than the spruce-salal forest, since it is usually more accessible and penetrable. None of the stands are located at, camping sites or points where hikers tend to stop, however, so it does not appear that any extensive damage is probable.

#### B. The Beaches, Near-Coast Terraces and Plains Subzone

This subzone includes all land in close proximity to the coastline where bedrock is not near enough to the surface to have any significant effect on the vegetation. The most common types of surficial deposits in this subzone are beach and dune sand, ablation till, marine till and glacial outwash. The beaches are geomorphologically the most active areas in the Park and directly responsible for the presence of several vegetation types. The till and outwash deposits are primarily associated with the coastal

plain of which only the ocean-facing scarp and lip are included within the Coastal Zone. Inland from the Lip of the coastal plain the oceanic influence, primarily in the form of wind and ocean spray, is not nearly so severe.

The vegetation in this subzone regularly forms strips paralleling the coast line. In general terms there are two sequences of types encountered in transects running perpendicular to the coastline and inland from the sea. In places where a vegetation-stabilized beach plain is fronted by an active beach, the sequence is as follows: the beach sand type, the beach rye herb type, the red alder-salal shrub type, the spruce-salal forest type, and the hemlock-spruce forest type. In locations where an active beach occurs in front of the coastal plain, the sequence is similar except for the addition of the spruce-sword fern forest type which normally occupies the scarp of the coastal plain. Where this occurs, the hemlock-spruce forest type is generally found on the inland side of the spruce-sword fern forest type.

As with the Rocky Headlands and Islands Subzone, the vegetation types of the sequences become progressively less exposed to the ocean the further inland they are found. In places where the beach is advancing in a seaward direction the sequence of types from bare sand to hemlock-spruce forest is a successional series with each type gradually moving into the area occupied by the next youngest stage.

#### B<sub>1</sub> The beach sand type (BS)

The unvegetated intertidal areas and most of the strand lying below the winter storm line comprise the beach sand type. This region is scoured by sea water during winter storms, so that it is free of logs and other debris

Table 5. Species Significance Values for Constant Species in the Vegetation Types of the Beaches, Near-Coast Terraces and Plains Subzones

STRATA		BEACH RYE HEGB TYPE	RED ALDER-SALAL SHRUB TYPE	SPRUCE-SALAL FOREST	SPRUCE-SWORD FERN FOREST	HEMLOCK-SPRUCE FOREST
A <sub>1</sub>	<i>Picea sitchensis</i>	-		5.4	6.5	3.7
	<i>Tsuga heterophylla</i>	-			2.3	5.5
A <sub>2</sub>	<i>Picea sitchensis</i>	-		4.1	4.5	2.3
	<i>Tsuga heterophylla</i>	-	-	-	2.3	3.9
A <sub>3</sub>	<i>Picea sitchensis</i>	-	-	2.5	3.1	
	<i>Alnus rubra</i>	-	-	-	2.5	
	<i>Tsuga heterophylla</i>	-	-	-		3.0
B <sub>1</sub>	<i>Alnus rubra</i>	-	4.2	-		
	<i>Lonicera involucrata</i>		2.6			
	<i>Picea sitchensis</i>		3.0	2.0		
	<i>Gaultheria shallon</i>		3.1	5.9	2.4	
	<i>Rubus spectabilis</i>	-	-	-	6.1	
	<i>Menziesia ferruginea</i>	-	-	-		2.4
	<i>Tsuga heterophylla</i>	-	-	-		2.2
B <sub>2</sub>	<i>Alnus rubra</i>	-	3.4	-		
	<i>Rosa nutkana</i>		2.4	-		
	<i>Lonicera involucrata</i>	-	3.2			
	<i>Gaultheria shallon</i>	-	5.8	8.5	4.5	5.6
	<i>Rubus spectabilis</i>	-	-	-	6.5	3.0
	<i>Vaccinium parvifolium</i>	-				2.8
C	<i>Elymus mollis</i>	5.2	-	-		
	<i>Carex macrocephala</i>	3.5	-	-		
	<i>Lathyrus japonicus</i>	3.0	-	-		
	<i>Honkenya peploides</i>	2.1	-	-		
	<i>Vicia gigantea</i>		1.6			
	<i>Pteridium aquilinum</i>		2.0	2.1		
	<i>Blechnum spicant</i>			1.5	1.9	4.5
	<i>Polystichum munitum</i>		-	-	5.6	
	<i>Athyrium filix-femina</i>		-	-	2.1	
	<i>Picea sitchensis</i>		-	-	1.5	
	<i>Maianthemum dilatatum</i>	-	-	-		2.8
	<i>Tsuga heterophylla</i>	-	-	-		1.7
<i>Tiarella trifoliata</i>	-	-	-		1.7	

Figure 9. Sequence of vegetation types on a wide sand beach. From right to left, the beach sand type, the beach rye herb type, the red alder-salal shrub type, and the spruce-salal forest type.

Figure 10. The beach rye herb type near the Darling River. Important species shown are beach rye (Elymus mollis), mace-headed sedge (Carex macrocephala), and Honkenya peploides.

which might act to stabilize the beach material. The instability and severity of this environment effectively restricts the invasion of terrestrial plants from the upper beach areas. The only species encountered are marine forms such as surfgrass, eelgrass and the algae Macrocystis which are washed up on the beaches after storms.

Throughout the length of Phase III the majority of beaches are composed of sand, although some shingle beaches do exist, particularly at the mouths of the larger streams. The most extensive beaches are located at the heads of the four major bays. Since the old trail has been abandoned in many places in favour of the more easily negotiable beach, use of this type is often quite heavy. Impact is minimal, however, due to the lack of vegetation and constant cleansing action of the ocean. Marine pollution in the form of oil spills constitutes the greatest threat to this type.

B<sub>2</sub> The beach rye herb type (Em)

The beach vegetation in the Phase III section of the Park is very similar to that in the Long Beach area (see Bell, 1972; Cordes and MacKenzie, 1972). It occurs along a gradient of increasing stability from the winter storm line, through the driftwood zone, to the shrub or forest fringe. It is a diverse community and a number of plant associations could be described depending on exposure, moisture conditions, and log cover. In general, the type occupies a very narrow strip less than 100 feet in width. It is best developed where subsurface moisture is present and on southern exposures which are somewhat protected and support an extensive driftwood zone.

The lowermost reaches of this community may extend beyond the driftwood into the zone which is frequently inundated during winter storms.

Scattered islands of Honkenya peploides and runners of mace-headed sedge (Carex macrocephala) are normally the only species encountered in this area. At Pachena Beach, the widest beach in Phase III, sea rocket (Cakile edentula) is also seen. Spearscale (Atriplex patula) is another very infrequently occurring species.

The driftwood zone offers an excellent interpretive opportunity for demonstrating the manner in which the activities of man may alter natural processes. Normally, the stabilization of active sand movement must occur via a succession of plant communities, from herb to shrub (Wiedemann, 1966); logging activities in British Columbia have had a pronounced effect on this beach stabilization process. Large Log booms, formerly used to move timber from inaccessible portions of the coast, were frequently broken up by heavy seas resulting in extensive driftwood zones on many beaches. These Logs have hastened the stabilization process by trapping windblown sand and by providing sheltered niches for the establishment of seedlings. Among the herbs which are commonly found in the driftwood zone are beach rye (Elymus mollis), giant vetch, beach pea (Lathyrus japonicus), and hedge nettle (Stachys y a e).

The most stable areas of the driftwood zone are transitional to the shrub fringe or spruce-salal forest and show the greatest variety of herb species. Beach rye may occur in tall, dense stands, while hemlock parsley (Conioselinum pacificum) and cow parsnip (Heracleum lanatum) are frequently present. Various shrubs such as salal, black twinberry, salmonberry and Nootka rose may also gain a foothold in this area.

Special associations which develop in specific habitats include baltic rush (Juncus balticus) and horsetails (Equisetum spp.) on seepage sites, while beach morning-glory (Convolvulus soldanella), black knotweed

(Polygonum paronychia), and yellow sand verberna (Abronia latifolia) occur on very dry sites. There are no extensive sand dunes such as exist at Wickaninnish Bay in the Long Beach area; however relatively large stabilized dunes can be seen at **Clo-oose**, the area south of Cheewhat River, and on the **Carmanah** River beach. Vegetation in these areas resembles the dry beach herb communities, although bearberry and ericaceous shrubs are more abundant.

Since most campsites, as well as part of the trail, are located on beaches, human use of this area is quite heavy. This usage is easily apparent from the amount of litter, the numerous makeshift shelters, and, in some instances, the lack of readily available firewood by late summer. Fortunately, there are no highly fragile vegetation areas such as the Wickaninnish sand dunes. Winter storms cleanse the beaches each year, and most of the species are well-adapted to disturbance in their severe environment.

### B<sub>3</sub> The red alder-salal shrub type (ArGs)

All shoreline vegetation is greatly influenced by wind which desiccates foliage, transports ocean spray and abrades the plants with sand. One of the most visible signs of this is the **wind-sculpting** of the dense shrub thickets which often form the first continuous non-herb vegetation type inland from the beaches. Like the **salal** shrub type of the Rocky Headlands and Islands Subzone, this shrub band is of minor areal extent and often does not appear on the vegetation map. It occurs on logs which, having been stabilized for some time, are **well** rotted. This is the first type inland from the sea where soil horizon development has begun to take place, as indicated by a thin surface layer of humus.

The shrub fringe is extremely dense and **impenetrable** with an average coverage value of 90%. Both the upper and Lower shrub layers are dominated by salal and red alder (*Alnus rubra*). Salal is the leading species in this type, ranging from one foot in height in the driftwood transition to ten feet at the forest margin. Red alder occurs in tree form near the forest margin but is limited to the shrub form in the more seaward parts of this type. It is most abundant in Locations which are not directly exposed to the open ocean and where ground water seepage is close to the surface. In the most active seepage sites, red elderberry (*Sambucus racemosa*) and willows (*Salix* spp.) are also common. Other shrubs in this type include black twinberry, Nootka rose, salmonberry and thimbleberry. Stunted Sitka spruce are often present indicating gradual succession to the **spruce-salal** type.

Herb growth is primarily limited to the seaward margin of this type where the shrub growth is not nearly so dense. As in the **salal** shrub type, bracken, giant vetch and wild lily-of-the-valley predominate; deer fern and beach rye are common in the more open seaward areas. Mats of bearberry sometimes form, for example, on the stabilized sand dunes at Clo-oose.

There are good examples of the red alder-salal shrub type on most of the beaches between Clo-oose and the Carmanah Lighthouse. This type is often lacking on the more exposed beaches where the **spruce-salal** forest extends right to the beach rye herb type. Use of the shrub fringe is minimal, and its extreme density and impenetrability make it resistant to damage.



B<sub>4</sub> 'The spruce-salal forest type (PsGsPa)

This spruce-salal type commonly occurs on the upper beach and the undulating beach plain where it forms the first forest stands inland from the ocean. It exists as a band along all of the beaches in the Phase III section of the Park, reaching a maximum width of approximately 300 feet on west-facing bays where exposure to the prevailing winds and waves is at a maximum. On protected beaches this band can be as narrow as thirty feet in width.

The physiognomy of these stands is quite similar to that of the rocky headland spruce-salal type. Seaward stands which receive large amounts of ocean spray have the characteristic hedgelike or wind-formed appearance. The less severely exposed stands are composed of large, widely spaced trees with a dense understory of salal. These spruce have a straight bole with very large branches. The branches are characteristically few in number, located on the upper half or third of the tree, and often somewhat longer on the seaward side. These open stands are by far the most common in the type.

The soil consists of mor humus with a mean thickness of five inches over a thick mineral layer varying from sand to clay in texture. Soil profiles are weakly to moderately well developed with either an LFH, C or an LFH, Ae, Bf, C sequence. These two types have been classified as Orthic Regosols and Minimal Podsol respectively.

The forest canopy is generally open with a mean coverage of 40%. This layer is dominated by Sitka spruce with the occasional western hemlock or western redcedar also being present. The larger spruce are 110 to 150 feet tall and are commonly 200 to 500 years old.

Figure 11. A stand of the spruce-salal forest type (PsGsPa) northwest of the Nitinat narrows. Note the open nature of the canopy and the dense salal shrub Layer.

Figure 12. Interior of a 450 year old stand belonging to the spruce-salal forest type (PsGsPa). The herb layer is dominated by deer fern while salal and salmonberry form the dense shrub Layer.

The open **nature** of the forest canopy allows a very dense understory of salal to develop in the shrub layer. This Layer has a mean coverage value of 95% and is virtually impenetrable. In addition to the salal there are scattered salmonberry, thimbleberry and Nootka rose in the shrub layer, all of which have negligible cover.

The herb Layer is minimal with bracken fern the most common species due to its ability to grow through the salal and occupy a position above it. There are also scattered deer fern, wild lily-of-the-valley and beach pea (Lathyrus japonicus). The most common mosses are Eurhynchium oregonum, Isoetecium stoloniferum and Eurhynchium praelongum; the liverwort Frullaria nisquallensis is also often abundant,

This **vegetation** type is very resistant to damage and recovers so rapidly from trimming where the trail passes through it that yearly maintenance is necessary.

#### B<sub>5</sub> The **spruce-sword** fern forest type (PsRsPa)

This type is most commonly found along the mid and Lower slopes of the coastal plain scarp where temporary, or occasionally permanent, seepage water is present. This water originates from the upper parts of the slope or from the surface of the coastal plain. Because of the slope conditions, these sites remain moist throughout the summer and are well-drained during the winter rainy season. In some locations, the seepage zone extends onto the beach plain at the foot of the scarp, allowing the spruce-sword fern forest to occupy this area as well. Fairly extensive areas of this type occur in the north half of Phase III; for example, the bays on both sides of Pachena Point and the coastline between Michigan Creek and Klanawa River.

Figure 13. A stand of the spruce-sword fern forest type growing on the **scarp** of the coastal plain. The deciduous trees in the Lower part of the stand are red alder.

Figure 14. A Large spruce in a stand of the spruce-sword fern forest type. Note the abundant sword fern and **salmonberry**.

The soils of this type are well drained and variable in terms of classification. The profiles examined are placed in either the Regosolic or Podsollic Orders. Most profiles have moderately thick to thick LFH horizon and a melanized layer, or Ah horizon. On some sites seepage water has apparently inhibited the development of Ae and Bf horizons. Gleysol may be present in sites where seepage water is very close to the surface.

The forest canopy has a mean coverage of 65% and is composed primarily of Sitka spruce with lesser amounts of western hemlock. Some of the largest trees in the Park are found in this type: Sitka spruce six or more feet in diameter and over 160 feet tall were observed in several different stands. Red alder may be present in locations where an opening in the canopy exists due to the death of one or more large, old Sitka spruces.

The shrub layer is dominated by salmonberry and has a mean coverage of 75%. This moderately dense shrub layer presents a definite obstacle to hikers, since salmonberry is armed with thorns. In the tall shrub layer salal, which can be up to twelve feet in height, is common and elderberry is frequently seen. Salal is nearly as abundant as salmonberry in the low shrub Sayer, and elderberry is once again common.

This productive forest type can have a herb layer covering as much as 50% of the forest floor, however the mean coverage is 30%. This Layer is dominated by sword fern (Polystichum munitum) which often occurs in pure stands. Lady fern (Athyrium filix-femina) and deer fern are also frequently seen, while wild lily-of-the-valley is occasionally present. A wide variety of mosses and liverworts is usually present, including Eurhynchium spp., Isoetecium stoloniferum, Mnium insigne, Mnium glabrescens, Hookeria lucens, and Frullania nisquallensis.

Within the spruce-sword fern type an occasional sheltered ravine cuts back into the coastal plain. These ravines serve as drainage channels and support, a predominantly deciduous forest which is similar to that found along interior streambanks. Red alder dominates the tree Layer, and amabilis fir (Abies amabilis) is relatively common; stink currant (Ribes bracteosum), false azalea and Alaska blueberry (Vaccinium alaskaense) are abundant in the tall shrub layer. Typical herbs include cow parsnip, coltsfoot (Petasites speciosa), western spring beauty (Montia sibirica) and bedstraw (Galium triflorum). This community is considered to be a variant of the spruce-sword fern forest type.

#### B<sub>6</sub> The hemlock-spruce forest type (ThPs)

Within the Coastal Zone, this type occurs furthest from the coast and occupies sites which have the greatest protection from the coastal climate. The type is transitional from the spruce-dominated forest types of the Coastal Zone to the hemlock- and redcedar-dominated forest types of the Interior Zone. It commonly forms a band fifty to 500 feet or more in width on the inland side of the spruce-salal type or the spruce-sword fern type and usually grades into the hemlock-deer fern type or the cedar-hemlock type.

The soils of this type are the most mature of all the soils in the Coastal Zone. The profiles examined had well developed LFH, Ae and B horizons and were placed in the Podsollic Order.

The forest canopy has a mean coverage value of 55%. Western hemlock is generally the most abundant species in all tree layers while Sitka spruce is very common in the A<sub>1</sub> and A<sub>2</sub> layers and the most numerous tree species on the seaward side of the stands. Inland, spruce become less

Figure 15. A stand of the hemlock-spruce forest type near the mouth of the Klanaawa River. The shrub fringe along the beach belongs to the red alder-salal shrub type.

Figure 16. Interior view of a fairly open stand of the hemlock-spruce forest type. The shrub layer is dominated by red huckleberry, salal and salmon-berry.

numerous and eventually drop out completely where this type grades into the Interior Zone forest types. This gradual transition made air photo interpretation of the inland boundary most difficult and, as a result, the width of the type may have been overestimated in some places.

The shrub Layer is moderately dense, having a mean coverage of 75%. Of all the Coastal Zone types, this transitional forest has the Largest number of constant species in the shrub Layers. The tall shrub Layer is dominated by red huckleberry (Vaccinium parvifolium) and salal; salmonberry and false azalea are also common. Salal dominates the Low shrub Layer while salmonberry, red huckleberry and false azalea are also common.

The herb layer has a mean coverage of 28% and is dominated by deer fern. Other common species in order of their significance include wild Lily-of-the-valley, sword fern, and Lace flower (Tiarella trifoliata). The most common mosses are Eurhynchium spp., Mnium glabrescens, Plagiothecium undulatum, Hylocomium splendens, Isothecium stoloniferum and Scoparia bolanderi.

This forest type is subject to trampling damage due to its openness and abundant herbs, but seems to recover quickly.

#### E. The Tidal Flat Subzone

The Tidal Flat Subzone includes estuarine salt marshes established at the mouths of slow-roving rivers and streams, and the mud flats surrounding the protected inlets on Cape Beale. These areas are influenced by tidal action and have restricted drainage and high soil salinity. Since such conditions exist beyond the region of tidal inundation, the inland boundary of the subzone extends past the high tide line and is best defined as that area where shrub or forest vegetation takes over from the halophytic herbs of the tidal flats.



Estuarine salt marshes are of several types. Small streams emptying onto sloping sand or shingle beaches fan cut to produce delta-shaped marshes dissected by wandering drainage channels. The best example of this type of marsh is found on Keeha Beach. The second type occurs where slow-moving rivers such as the Cheewhat and Gordon reach sea level, producing marshy flats which are inundated during very high tides and winter storms. Ocean water travels a considerable distance up these rivers during these high tides and storms due to the gentle river gradient, so that such marshes may extend well inland. The mud flats on Cape Beale are gently-sloping clay and mud deposits at the heads of protected inlets.

For mapping purposes, only one vegetation type has been recognized for the Tidal Flat Subzone: the tufted hairgrass type. This rather generalized type has been broken down into a number of more specific plant communities, or associations, for purposes of discussing the ecology of the tidal flats. However, these associations are, for the most part, too small and discontinuous to be mapped at the scale employed.

#### E<sub>1</sub> The tufted hairgrass type (DcSv)

The tufted hairgrass or estuarine type is a herb community dominated by a variety of grasses and sedges. It occurs on marine and fluvial deposits ranging from organic mud to clay, sand and shingle. The five best examples of this type occur at Bamfield Inlet, behind Mud Cove on Cape Beale, at Keeha Beach, and at the mouths of the Cheewhat and Gordon Rivers. The Cheewhat marsh is particularly extensive and rich in both flora and fauna.

This vegetation type has been divided into a series of distinct communities or plant associations situated along a gradient determined by

Figure 17. The tufted hairgrass type in the Cheewhat River estuary. The dominant species here are tufted hairgrass (Deschampsia cespitosa) and meadow barley (Hordeum brachyantherum).

Figure 18. The tufted hairgrass type in a small, protected bay on Cape Beak.

degree of tidal influence. These are, in order of decreasing tidal influence: 1) Distichlis association, 2) Carex association, 3) Deschampsia/Hordeum association, and 4) Calamagrostis Elymus association.

The Distichlis association occurs on the Lowest vegetated mud or sand and is inundated to a depth of several inches during high tides. Saltgrass (Distichlis spicata) forms a narrow homogeneous band while alkali-grass (Puccinellia pumila) is also occasionally found. Ditch grass (Ruppia maritima), which dominates the corresponding plant association of the Long Beach area (Bell, 1972) was not discovered in this phase of the Park. Similarly, Zostera was not found to be nearly as abundant as reported by Bell for the Long Beach area. Beds of Zostera do exist in Bamfield Inlet, but do not approach those of Grice Bay in expanse.

At a slightly higher Level, which is normally free of **sea** water during low summer tides, homogeneous patches of Carex lyngbyei are usually seen; this has been termed the Carex association. The stands of Carex may **extend** down into the Distichlis zone **as** well. Beneath the sedge, a variety of halophyte such as glasswort (Salicornia virginica), seaside arrowgrass (Triglochin spp.), Lilaeopsis occidentalis, marine plantain (Plantago maritima) and Scirpus cernuus are common.

The Deschampsia/Hordeum association forms a broad belt on the estuarine terraces and higher portions of the inlet areas and is the most extensive of the tidal flat **communities**. In all areas but the Cheewhat estuary, tufted hairgrass (Deschampsia cespitosa) dominates this association, while Juncus effusus and various salt tolerant grasses are common. At Cheewhat, however, Hordeum brachyantherum (meadow barley) predominates in this middle region while Deschampsia is only a minor component. Since the Cheewhat estuary accounts for such a Large proportion of this vegetation type, the

Hordeum association has been described as an alternate form of the Deschampsia association, rather than as a variant. Ground-level herbs are the same in both situations and include such species as Potentilla pacifica (Pacific silverweed), bedstraw (Galium triflorum) and spring-bank clover (Trifolium wormskjoldii).

Next to the forest or shrub transition areas, a narrow band of Calamagrostis nutkaensis (Pacific reedgrass) normally occurs. In the Cheewhat estuary this species is replaced by Elymus mollis, however, so that the association has been termed Calamagrostis/Elymus to indicate the two alternate forms. This is the most protected of the plant associations, and often occurs on and behind a narrow driftwood zone. Giant horsetail (Equisetum telmateia) and yarrow are frequently seen in this association.

The tufted hairgrass type grades abruptly into either the riverine spruce-hemlock forest, in the case of inland portions of estuaries; or into the spruce-salal forest of the immediate coast. In either case a diverse shrub transition zone is usually present and includes such species as black twinberry, Nootka rose, Pacific crab apple and sweet gale, among others. This transition zone is best developed on the most protected estuary sites.

The estuarine areas and salt marshes are among the most interesting and varied of the plant communities in a botanical sense, but do not offer much attraction for the typical hiker. They are difficult to negotiate and do not occur on the immediate trail so that usage and impact are minimal.

## II. THE INTERIOR ZONE

The Interior Zone is divided into three subzones: the Coastal Plain Subzone, the Rock Outcrop Subzone and the Riverine Subzone. As in the Coastal Zone, the primary distribution of the subzones is based on differences in parent material and landforms which, either directly or indirectly, have a major **controlling** influence on the distribution of the various vegetation types.

### c. The Coastal Plain Subzone

The Coastal Plain Subzone is by far the most extensive subzone in the Phase III section of the Park. It commonly begins several hundred feet or less from the coastline and extends past the inland boundary of the Park. Most of the plain lies between 50 and 150 feet above sea level. Where the plain lies in close proximity to the coastline, a small portion of it may be included within the Coastal Zone. The **scarp** which occurs between the surface of the plain and the coastline is **generally** vegetated by the Coastal Zone's spruce-sword fern and hemlock-spruce forest types.

In general, the plain is flat to undulating and made up of clay, sand and gravel deposits of glacial or glacial-marine origin. Surface drainage is controlled by topography and parent material and is the single most important factor determining the vegetation pattern. The types in the subzone, listed in order of good to poor drainage, are: the hemlock-deer fern forest, the cedar-hemlock forest, the cedar muskeg forest, the shore pine bog forest and the water lily type. In places the plain slopes inland towards a depression, producing a drainage gradient along which all the vegetation types of the subzone can be found in the previously mentioned sequence. However, in reality one or more of the types is usually missing in any one transect taken inland across the plain.

Table 6. Species Significance Values for Constant Species in the Vegetation Types of the Coastal Plains Subzone

STRATA		C <sub>1</sub> HEMLOCK-DEER FERN FOREST	C <sub>2</sub> CEDAR-HEMLOCK FOREST	C <sub>3</sub> CEDAR MUSKEG FOREST	C <sub>4</sub> SHORE PINE BOG FOREST	C <sub>5</sub> SPHAGNUM BOG TYPE
A <sub>1</sub>	<i>Abies amabilis</i>	3.5				
	<i>Tsuga heterophylla</i>	6.7	4.2	3.8		
	<i>Thuja plicata</i>	-	4.9	4.9		
	<i>Pinus contorta</i>	-			2.2	
A <sub>2</sub>	<i>Abies amabilis</i>	2.2				
	<i>Tsuga heterophylla</i>	4.0	3.2	2.7		
	<i>Thuja plicata</i>		3.3	3.6		
	<i>Pinus contorta</i>				1.6	
A <sub>3</sub>	<i>Tsuga heterophylla</i>	2.6	3.0	2.6		
	<i>Thuja plicata</i>		2.1	3.3	1.8	
	<i>Pinus contorta</i>	-			3.6	
B <sub>1</sub>	<i>Menziesia ferruginea</i>	3.0	3.0			
	<i>Vaccinium parvifolium</i>	3.4	3.0			
	<i>Tsuga heterophylla</i>	6.3	3.0	2.9		
	<i>Gaultheria shallon</i>	2.4	4.0	3.6		
	<i>Thuja plicata</i>			2.4	2.8	3.0
	<i>Pinus oontorta</i>	-			4.4	
B <sub>2</sub>	<i>Menziesia ferruginea</i>	2.3	2.0	2.1		
	<i>Vaccinium parvifolium</i>	3.9	3.0	3.3		
	<i>Gaultheria shallon</i>	5.3	6.6	5.7		
	<i>Tsuga heterophylla</i>	3.4	1.7	2.1	2.4	
	<i>Thuja plicata</i>	-		2.1	2.6	2.8
	<i>Pinus oontorta</i>	-			4.0	
	<i>Kalmia polifolia</i>	-				3.0
	<i>Ledum groenlandicum</i>	-				2.0
C	<i>Blechnum spioant</i>	5.1	5.1	4.0	2.4	
	<i>Tsuga heterophylla</i>	2.3	2.0	2.1	2.4	
	<i>Maianthemum dilatatum</i>	-	3.3	1.7		
	<i>Lysichitum americanum</i>	-		1.6		
	<i>Empetrum nigrum</i>	-			3.0	
	<i>Linnaea borealis</i>	-			2.6	
	<i>Cornus unalaaohkensis</i>	-			2.4	
	<i>Drosora rotundifolia</i>	-			3.14	3.8
	<i>Vaccinium oxycocous</i>	-			3.2	2.8
	<i>Carex obnupta</i>	-			3.2	2.4
	<i>Scirpus cespitosus</i>	-				4.4
	<i>Sanguisorba officinalis</i>	-				4.0
	<i>Rhynchospora alba</i>	-				3.8
	<i>Coptis asplenifolia</i>	-				2.6
	<i>Centia douglasiana</i>	-				2.11

C<sub>1</sub> The hemlock-deer fern forest type (ThBs )

This hemlock-deer fern forest type occurs in small stream valleys and other sites which have a slope gradient steep enough to allow sufficient drainage so that the soil does not remain waterlogged for long periods of time during the heavy winter and spring rains. This type is limited in extent because much of the coastal plain is only moderately well drained.

This is the most productive forest type in the Park, with trees up to 200 feet in height and over five feet in diameter. Stands made up of these large trees generally have a closed canopy, which results in a sparse shrub layer. The herb layer, however, is well represented and dominated by deer fern. Excellent examples of these stands can be seen along the trail between the Pachena Point lighthouse and the mouth of Michigan Creek.

Soils of this type are quite variable ranging from podzols on the better drained sites to gleysols and regosols on the seepage sites. The surface soil is either a fibrous or felty mor humus in podzolic and gleysolic profiles or a mull humus in regosolic profiles. Humus layers are generally quite thin compared to the other types in this subzone. Depth of rooting is considerably better than the other types with depths of three feet or more being common.

The tree layer has a mean coverage of 60%, and the major species are western hemlock and amabilis fir. Dense stands of hemlock with the occasional fir occur on the better drained sites, while more open stands of hemlock interspersed with western red cedar and Sitka spruce dominate the less well-drained sites within the type.

The shrub layers are somewhat open, with a mean coverage of 60%. Young hemlock dominate the tall shrub layer, while common shrub species are red huckleberry, false azalea, salal and salmonberry. The low shrub

layer is dominated by salal and also includes red huckleberry, hemlock, salmonberry, false azalea and evergreen huckleberry (Vaccinium ovatum). Since the shrub layer is more open than in other forest types, hiking is usually much easier in these stands than closer to the coast, where the salal shrub layer is extremely dense.

The herb layer has a mean coverage of 30%; the dominant and by far most abundant species is deer fern. Seedlings of hemlock, salal and red huckleberry are common on rotting "nurse logs". Other common herbs include sword fern and wild lily-of-the-valley, while skunk cabbage (Lysichitum americanum) is occasionally found in small depressions. Mosses are common, and include Eurhynchium spp., Rhytidiadelphus loreus, P lagiothecium undulatum, Calypogeia sp. and Isothecium stoloniferum.

As this forest type is highly productive and well drained, damage due to human usage does not represent a serious problem at this time.

#### C<sub>2</sub> The cedar-hemlock forest type (TpTh)

This type is less well drained than the hemlock-deer fern forest type as it is located further away from streams and the coastal plain scarp. Since the majority of the plain is only moderately well drained, this forest type dominates this subzone, and, as a result, is the most common vegetation type in Phase III.

The water table is close to the surface during the rainy season and drops to approximately five feet or more below the surface by late summer. **Soils** observed were either gleysols or gleyed podsols. They consist of a mor humus layer up to twelve inches in thickness, a leached Ae horizon and a gleyed B horizon. Clay is the most common parent material although sand is present at some sites.



Figure 21. The cedar-hemlock forest type on the shore of Kichha Lake.

Figure 22. The inside of a stand belonging to the cedar-hemlock forest type. Common shrubs are salal, false azalea and red huckleberry.

The dominant tree species are western redcedar and western hemlock. Redcedar often exhibits poor vigor and many individuals are stunted and have heart rot. Although less numerous, hemlock shows better vigor and appears to be reproducing more vigorously than the cedar. *Amabilis fir* is fairly common on the better drained sites. Most stands are between 100 and 150 feet tall and the older trees are over 300 years of age.

The forest canopy is open, having a mean coverage of 40%. This has allowed a moderately dense shrub layer to develop, which has a mean coverage of 75% and is dominated by salal. Common species in the tall shrub layer, in order of significance, include false azalea, red huckleberry, hemlock and salmonberry. In the low shrub layer red huckleberry, salmonberry and false azalea are the most common species,

The herb layer has a mean coverage of 30% and deer fern is again the dominant species. Wild lily-of-the-valley and seedlings of hemlock and red huckleberry are common while skunk cabbage is quite abundant in poorly drained sites where black muck has accumulated. Licorice fern (*Polypodium glycyrrhiza*) is a common but inconspicuous epiphyte on redcedar and may grow at considerable heights above the ground. Mosses include *Rhytidiadelphus loreus*, *Hylocomium splendens*, *Isoetes macrospora*, *Mnium glabrescens* and *Sphagnum palustre*.

Because this type covers a large area of the park, many miles of the Lifesaving Trail are located within it. After hiking for a mile or so in this forest, it can become rather unstimulating, and this accounts for the monotony many hikers complain about after having done the trail. This problem might be alleviated by moving some inland sections of the trail closer to the coast, within view of the ocean. More important, it would help to overcome the deterioration of the trail which is occurring with

increased usage. As previously stated, the water table in the cedar-hemlock forest is extremely high early in the summer; this means that hikers are essentially walking on a strip of mud cleared of all vegetation. If rainy weather persists for several days in a row, and large groups of hikers walk through these areas, the trail deteriorates into quagmire, and large puddles which take weeks to disappear are produced. Relocation of some sections of the trail, and limits on the size of hiking groups permitted seem the most practical solutions to these problems.

### C<sub>3</sub> The cedar muskeg forest type (Tp)

This type is found on sites with more restricted drainage than those of the cedar-hemlock forest, and it covers a smaller area. Standing water is common during periods of heavy rainfall, while late summer finds the water table at approximately two to three feet below the surface. However, in many places the water table is closer to the surface and where the trail crosses these areas it becomes quite muddy,

The side trail from Clo-oose to Brown's Cove passes through cedar muskeg forest, and presents an excellent example of how the problem of trail degradation in such areas can be overcome. At one time this trail was regularly used by local residents, and over a mile of boardwalk was constructed in order to avoid the mud. Having been constructed of rough-hewn cedar, this boardwalk is still quite serviceable today, although a few boards are now loose. Such boardwalks should be built in other sections of the cedar muskeg type where the water table is close to the surface in order to mitigate against the effects of increased usage. These areas will otherwise be badly torn up by hiking activities, and, in addition, they are extremely difficult to negotiate as they now exist.

Figure 23. The cedar muskeg forest type on the shore of Kichha Lake. Note the poor form and dead tops on most of the redcedar.

Figure 24. Interior of a stand belonging to the cedar muskeg forest type. Both western **redcedar** and western hemlock are abundant in this stand.

The wet soil conditions of this type have resulted in the development of gleysols or gleyed podsols. The profiles are similar to those of the cedar-hemlock type with the exception of the gleyed B horizon, which is better developed. Texture of the parent material ranges from clay to sand. In sandy areas an iron pan at the bottom of the B horizon is often present and acts as a deterrent to the downward movement of water.

Forest stands in this type consist of western redcedar and western hemlock. The muskeg forest is distinguished from the previous type by having trees with very poor growth form and a lower forest canopy which varies between forty and eighty feet, depending on local drainage conditions. Stunted cedar with "candelabrum" branching is the leading tree species although hemlock shows better regeneration. The canopy density is similar to that of the cedar-hemlock type having a mean coverage of 45%.

Coverage in the shrub layer is also similar to the cedar-hemlock type, with a mean value of 73%, with salal again being the dominant species. The tall shrub layer, however, contains more redcedar and hemlock, while red huckleberry and salmonberry are less abundant than in the previous type. In the low shrub layer red huckleberry, evergreen huckleberry and Alaska blueberry are more abundant than hemlock and redcedar.

Coverage in the herb layer is 30% and the dominant species is deer fern. Seedlings of hemlock, cedar and red huckleberry are common on stumps and rotting logs; wild lily-of-the-valley, skunk cabbage, twinflower and bunchberry (Cornus unalashkensis) are the most frequent herbs. In the areas where surface water accumulates, slough sedge (Carex obnupta) and Juncus effusus are often common; Sphagnum spp. forms mats and hummocks in such areas along with various bog species of herbs. Other mosses include Rhytidiadelphus loreus, Hylocomium splendens and Isoetecium stoloniferum.

C<sub>4</sub> The shore pine bog forest type (PC)

The pine bog forest is the most poorly drained of the forest types, and occupies flat areas or shallow depressions, often on the periphery of the sphagnum bog type. Incising of local stream channels, a process which tends to improve drainage, is lacking in these sites. Poor internal drainage of the soil is due to the presence of a very hard and impervious iron pan which is usually present within a foot of the top of the mineral soil. Soils are typically gleysols and gleysol podsols with greasy mor humus layers of variable thickness,

The best example of this type on the Lifesaving Trail can be seen where the trail swings inland between Walbran and Logan Creeks. During this section, it passes through a pine bog forest for approximately 300 yards. The area is attractive to walk through because of its openness, a relief after the closed cedar-hemlock forest which precedes it. The trail here is in very good condition, and does not deteriorate with heavy use to as great an extent as would be expected. This is primarily because boardwalks have been constructed over the wettest portions.

The forest cover in this type is very open (less than 25% coverage), and composed primarily of stunted, bushy shore pine (Pinus contorta) less than 40 feet in height but usually well over 100 years old. Similarly stunted redcedar and hemlock are far less common. Yellow cedar (Chamaecyparis nootkatensis) may be present in some of these bogs but was not discovered, despite frequent checking.

The shrub layers have a mean coverage of 50%, most of which occurs in the lower layer. The upper layer is very similar in composition to the tree strata, but redcedar and hemlock are more common; evergreen huckleberry is the only shrub species present. The low shrub layer again features

Figure 25'. A view of the shore pine bog forest type. Trees are stunted and exhibit very poor form in this type.

Figure 26. The interior of a stand belonging to the shore pine bog forest type. Note the dense herb layer.

the three tree species along with sweet gale (Myrica gale), Labrador tea (Ledum groenlandicum), bog laurel (Kalmia polifolia), salal and evergreen huckleberry. Myrica may be very dense in some pine bogs such as those near the Cape Beale lighthouse. Some of these might actually be considered as a separate variant of the pine bog community. Wade (1965), after intensive study of bogs in the Long Beach area, proposed such a variant within his Pinus contorta - Sphagnum capillaceum association, a transitional bog forest peripheral to the true bog community.

The herb layer is rich, averaging a 70% coverage value. In general, the herbs occur on two different habitats, and so might be conveniently separated into two groups. On the sphagnum hummocks which have developed around the bases of the trees, species which can normally be found in much drier habitats occur: crowberry (Empetrum nigrum), twinflower, deer fern and bunchberry. Rooted in the moist sphagnum mats are typical bog species such as round-leaved sundew (Drosera rotundifolia), bog cranberry (Vaccinium oxycoccus), bog dandelion (Apargidium boreale), goldthread (Coptis asplenifolia) and burnet (Sanguisorba officinalis). Slough sedge (Carex obnupta) is very common, while skunk cabbage grows in pools of water and decayed sphagnum. Skunk cabbage appears to be a preferred item in the diet of black bears: by midsummer most of the plants in the bog forests on Cape Beale had been dug up by bears attempting to reach the succulent roots.

The moss layer is, of course, extremely luxurious; various species of Sphagnum form an almost continuous cover, and might collectively be considered the true dominant plant group. Sphagnum recurvum and s. papillosum appear to be the most abundant species.



The sensitivity of this vegetation type has already been discussed. Construction and maintenance of boardwalks is imperative in those areas where the trail passes through pine bog forests.

C<sub>5</sub> The sphagnum bog type (SpLg)

The sphagnum bog type occurs in shallow depressions on the coastal plain, It is the wettest of the terrestrial vegetation types, and develops due to the presence of excessive moisture at or near the soil surface.

The water table remains at or very close to the flat surface of the bog throughout the year, and standing water is common, especially during the winter months. Soils are primarily organic, being composed of accumulations of sphagnum peat which may be five feet or more in thickness.

This type differs from the pine bog forest in the extreme sparsity of the tree layer, and in the presence of standing water. According to Wade's classification system (1965), the sphagnum bog type would consist primarily of low moor bog, with very scattered high moor bog associations developing as organic buildup above the water table on the sphagnum hummocks formed around the bases of the scattered trees. The five major examples of the sphagnum bog type occur at the following Locations: to the northeast of Kichha Lake; on the trail to the Cape Beale Lighthouse; one mile north of the Klanawa River mouth; between Walbran and Logan Creeks; and between Logan and Cullite Creeks. The bog by Kichha Lake is by far the largest but is inaccessible by foot. The extensive Cullite bog, however, is transected by the trail and so is easily observed by hikers.

The "tree" layer of this type consists of a few scattered western redcedar and shore pine, all of which are very stunted and less than 20 feet in height. Western white pine (Pinus monticola) may also be common

Figure 27. The sphagnum bog type on the edge of Kichha Lake.

Figure 28. A close-up view of the sphagnum bog type. Note the stunted, shrub-like western redcedar.

in those bogs with rather shallow peat accumulations, Shrubs are a conspicuous element of the vegetation, and normally cover 50% to 60% of the total ground area. Bog laurel, sweet gale and Labrador tea are the most common and consistent species. They are part of the high moor association which develops on raised sphagnum hummocks. Black crowberry, a characteristic element of the drier portions of the pine bog forest, is not common in the sphagnum bog type.

Herb layer vegetation is extremely abundant and varied. The herbs are rooted directly in the mats of wet sphagnum, and cover 80% or more of its surface. Scirpus cespitosus (tufted clubrush), burnet (Sanguisorba officinalis), round-leaved sundew, Rhynchospora alba (beak-rush), bog cranberry and goldthread are ubiquitous in the bogs and show little habitat preference. Sedges such as Carex obnupta, C. phyllomanica and C. livida usually grow in areas where wet mud is exposed, such as around the margins of the open bodies of water. Many species are unique to one particular bog location, such as Drosera anglica, which was discovered only in the bog near the Cape Beale lighthouse. These exclusive occurrences seem to be due to differences in exposure of the bog and degree of sphagnum accumulation.

Many of the bogs appear to be expanding in size, and are extending into the peripheral bog forests or muskeg forests. This is most readily evidenced by the abundance of dead and dying areas on the circumference of some bogs, and by the existence of typical muskeg forest species in these areas. Skunk cabbage, which grows in isolated pools of decayed muck, is the most common of such stranded forest, species which can survive bog conditions on scattered islands of the appropriate habitat.

The sphagnum moss cover is almost 100%, and the most common species are Sphagnum papillosum, S. squarrosum, S. recurvum, S. palustre and

S. mendocinum. A detailed breakdown of the bog plant associations, and of variation in the Sphagnum species was felt to be beyond the scope of this study, particularly in view of the work already completed by Wade (1965).

While the sphagnum bogs are among the most varied of the plant communities, they are, like the preceding two vegetation types, extremely susceptible to damage. Due to the depth of the peat accumulation, it is usually impossible or impractical to construct boardwalks over the bogs, so that they should be avoided completely as far as the routing of the trail is concerned. Unfortunately, the trail currently passes through the centre of the largest accessible bog - that between Cullite and Logan Creeks. This circumstance is causing severe damage to the vegetation, and renders hiking through the area a miserable experience. By midsummer, the original trail is impossible to walk on, and hikers fan out in all directions in attempts to negotiate the bog, so that much of the area turns into a mass of churned thigh-deep mud. It is strongly recommended that this portion of the trail be relocated closer to the coast, or along the beach where possible, in order to halt this damage to the vegetation and make hiking more pleasurable.

#### C<sub>6</sub> The water lily type (Np)

The water lily type is an aquatic community found in fresh-water bodies, including lakes, ponds and open water areas in sphagnum bogs. It is the least extensive of the community types in the Coastal Plain Subzone and involves only aquatic elements; the terrestrial shoreline communities in most cases are classified as sphagnum bog or pine bog forest. Constantly submerged eutrophic organic muck underlies this type and serves as the substrate for the rooting plants.

Figure 29. The water lily type on a pond inland from Keeha Bay.

Figure 30. A view of the water lily type in a shallow part of Kichha Lake. **Buckbean** (Myanthes trifoliata) is the dominant species in the foreground while a rush (Scirpus validus) predominates further **back**.

The two major fresh-water lakes within the study area are Kichha Lake on Cape Beale, and the smaller lake on the side trail from Clooose to Brown's Cove. They compose the majority of the areal extent of this type and include the greatest variety of species. The water bodies of the sphagnum bogs are much smaller and usually contain only fragments of the total species range of the lakes. In most cases yellow pond lily (Nuphar polysepalum) is the most common and conspicuous plant in this vegetation type. It grows in shallow water up to approximately six feet -in depth, and so occurs only around the margins of the lakes, but may cover the entire surface of water bodies in sphagnum bogs. Water shield (Brasenia schreberi) is another common element, found in deeper open water as well as in the shallow areas with Nuphar. Potamogeton species are common in the lakes, but not as frequent in bog areas. At Kichha Lake, stands of buckbean (Menyanthes trifoliata) and Dulichium arundinaceum form distinct communities around the southern shoreline; otherwise these species are rare within the Park. Bladderwort (Utricularia vulgaris) is another rare species, found only in the deep, cool water of this lake.

Kichha Lake presents an interesting situation in that it is being filled in by the sphagnum bogs which are advancing from several areas along the shoreline. A definite successional pattern occurs which is clearly visible at several locations along the shoreline. The first successional stage involves the establishment of large homogeneous stands of Scirpus validus; these rushes then begin to die, and form a mat on which Sphagnum spp. may advance out into the water. The mosses and dead rushes produce an extremely dense semi-stable floating mat, which serves as a substrate for the establishment of a series of vascular plants. Carex obnupta is generally the first of these, followed by the bog shrubs Myrica, Kalmia and

Ledum. Eventually the buildup of organic debris beneath the floating mat stabilizes it completely, and the shoreline essentially advances as a sphagnum bog community. This successional process is complicated by the fact that the water table has apparently been fluctuating by several feet, as indicated by water marks and submerged trees on the shoreline. The introduction of beaver into the lake may have had some bearing on this phenomenon.

Since none of the lakes studied contain sport fish of an attractive size, their use is not heavy, and human disturbance does not appear to be an important factor at this time.

#### D. The Rock Outcrop Subzone

The Rock Outcrop Subzone consists of bedrock knolls and some inland extensions of the rocky headlands which are out of the zone of strong coastal climatic influence. The most extensive areas of rock knolls are located northwest, of Owen Point and on the interior of Cape Beale, an area which is transected by the trail to the Cape Beale lighthouse. Only one type, the hemlock-shore pine scrub forest, exists within this subzone.

#### D<sub>1</sub> The hemlock,-shore pine scrub forest type (TpPc)

This type develops on the rocky to thinly drift-covered surfaces which are scattered throughout the Park. The topography is irregular, consisting of slopes of varying degrees of steepness, depressions, and some relatively flat areas. In general, the higher parts have steep slopes and consist largely of rock outcrops with small patches of till. Rock outcrops also predominate on the lower, less steep areas; however till patches are somewhat more common here. Mineral soil, organic matter and ground water accumulate in rocky depressions which support a forest

Table 7. Species Significance Values for Constant Species  
in the Hemlock-Shcre Pine Scrub Forest Type  
of the Rock Outcrop Subzone.

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A <sub>1</sub>	Thuja plicata	5.0
	Tsuga heterophylla	4.0
	Pinus contorta	1.0
A <sub>2</sub>	Thuja plicata	3.6
	Tsuga heterophylla	3.4
A <sub>3</sub>	Thuja plicata	2.8
	Tsuga heterophylla	2.6
B <sub>1</sub>	Menziesia ferruginea	3.2
B <sub>2</sub>	Gaultheria shallon	5.2
	Vaccinium parvifolium	3.4
	Menaiesia ferruginea	2.4
	Tsuga heterophylla	2.2
C	Blechnum spicant	5.2
	Maianthemum dilatatum	3.0
	Tsuga heterophylla	2.6



Figure 31. The hemlock-shore pine scrub forest type near Cape Beale.

Figure 32. A view of the hemlock-shore pine scrub forest type along the trail to Cape Beale. Note the rock outcrop in the lower part of the photo.

similar to the cedar muskeg type. The soil is quite variable as a result of the irregularities in topography, drainage and soil depth. Lithic Regosols are common on rocky outcrop areas, where the entire profile consists of only a mor humus layer of variable thickness. Either pod soils or gleysols develop on sites which possess some mineral soil, depending on drainage conditions. Soils belonging to the Organic Order are sometimes present in depressions.

The composition of the forest varies considerably in response to the same group of factors which affect soil genesis. Western redcedar, western hemlock and scattered shore pine are present throughout the type, however the abundance of each species varies substantially from place to place. Cedar and shore pine both increase in abundance as drainage becomes poorer.

In general, the forest is of an open nature having a mean tree coverage of 40%. Canopy height varies from thirty to fifty feet while most individuals are 150 to 300 years or more of age. Poor vigor is exhibited by all tree species: slow growth rates, poor form and dead crowns are common throughout the forest. Hemlock, and, to a lesser extent, cedar appear to be regenerating successfully.

The shrub layers have a mean coverage of 66%, most of which occurs in the low shrub layer. False azalea is the dominant species in the tall shrub layer, followed by hemlock, evergreen huckleberry and redcedar. Pacific crab apple may be abundant in moist depressions. The low shrub layer is predominantly salal, while red huckleberry, evergreen huckleberry, false azalea and hemlock are usually common. Shallow soils and poor drainage conditions appear to restrict the development of the shrub layers, even though the tree canopy is much more open in these locations.

The herb layer has a mean coverage of 28% and is dominated by deer fern. Wild lily-of-the-valley and seedlings of red huckleberry and hemlock are common. These seedlings are primarily restricted to deadfall and organic hummocks which develop around the bases of the trees, Sword fern occurs on moist but well-drained sites. Mosses include Rhytidiadelphus loreus, Eurhynchium spp., Hypnum sp., and Calyptogeia trichomanis.

In regard to human usage, poorly-drained sites in this forest type present the same difficulties associated with the cedar muskeg forest. Fortunately, most of the scrub forests crossed by the trail itself are fairly dry, although some exceptions occur in the Cape Beale area.

#### G. The Riverine Subzone

The Phase III area contains a number of streams and small rivers, most of which have their sources in the more inland parts of Vancouver Island. The base level for these streams is sea level, which is generally 50 - 150 feet below the level of the coastal plain. The smaller streams descend rapidly from the coastal plain to sea level through steep-sided gorges which are completely devoid of flood plains. Therefore, these streams have little effect in producing a vegetation type with typical riverine characteristics. Larger streams, on the other hand, have cut much deeper and wider valleys in the coastal plain and presently contain flood plains which begin at the coast and extend inland. It is on these floodplain and low river terraces that the spruce-hemlock forest type is found.

Only small areas of this type are present in Phase III, or in the entire Park for that matter. Small stands occur along Pachena River, Gordon River and Walbran Creek as well as along several other creeks.

Table 8. Species Significance Values for Constant Species in the Spruce-Hemlock Forest Type of the Riverine Subzone.

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A <sub>1</sub>	Picea sitchensis	5.4
	Tsuga heterophylla	3.1
A <sub>2</sub>	Picea sitchensis	3.3
	Tsuga heterophylla	2.4
A <sub>3</sub>	Picea sitchensis	3.0
B <sub>1</sub>	Rubus spectabilis	4.4
B <sub>2</sub>	Rubus spectabilis	4.9
	Gaultheria shallon	3.3
	Vaccinium ovalifolium	2.3
C	Blechnum spicant	3.6
	Polystichum munitum	2.7
	Maianthemum dilatatum	3.0
	Tiarella trifoliata	2.6

A fairly extensive area of this type along the Pachena River has been logged. Other fairly large areas in the Pachena River valley are outside the Park. The spruce-hemlock flood plain type has special significance in that, it is probably the most highly productive forest ecosystem in Canada. The lack of any extensive area of this type within a national park and ways that this problem might be rectified should receive further attention by the Park's planners.

G<sub>1</sub> The spruce-hemlock forest type (PsTh)

This type is similar to the spruce-sword fern type in terms of dominant species, but has a far more diverse composition. One of the major differences between these types is the landforms on which they occur: the spruce-sword fern type is located on scarps facing the sea, while the spruce-hemlock forest type is found on small floodplains somewhat removed from the immediate coast. These small flood plains can extend inland for some distance, providing the only habitat on which Sitka spruce, otherwise a strictly coastal species, may occur as an inland dominant.

The soils of the type have a felty mor humus layer up to ten inches in thickness. These mature soils are predominantly podsols with well-developed LFH, Ae and B horizons. More active parts of the flood plain have immature soils belonging to the Regosolic Order.

The dominant and codominant trees are often three to five feet in diameter and 150 to 200 feet or more in height. The forest canopy is fairly open, having a mean coverage value of 57%, and is usually dominated by Sitka spruce. Western hemlock is the leading codominant species while red alder is abundant on the immediate streambank. Amabilis fir and western redcedar are commonly present in small numbers.

Figure 33. The spruce-hemlock forest type along the Klanawa River.

Figure 34. Interior view of a stand belonging to the spruce-hemlock forest type. Shrubs in the photo include salal, salmonberry and oval-leaved blueberry.

Coverage in the shrub layers is fairly open (60%), but the shrubs are luxuriant in growth. This is the only type in which the tall shrub layer is more dense than the low shrub layer, primarily due to the occurrence of deciduous species such as red alder, Pacific crab apple and stink currant. Other common shrubs in the tall shrub layer include false azalea, oval-leaved blueberry (Vaccinium ovalifolium) and red huckleberry. Salal, oval-leaved blueberry, false azalea and red huckleberry are common in the low shrub layer. The abundance of fruit-bearing shrubs results in very good berry picking along stream and river banks.

The herb layer is abundant (45% coverage) and diverse in composition; this type has more herb species than any other forest type. Many of these species are uncommon or rare, being restricted in occurrence to one or several areas. Among such plants are false bugbane (Trautvetteria caroliniensis), mountain valerian (Valeriana sitchensis), western trillium (Trillium ovatum), Habenaria hyperborea (green-f lowered bog orchid), shooting star (Dodecatheon jeffreyi) and marsh horsetail (Equisetum palustre). The constant and characteristic riverine species include deer fern (the dominant), wild Lily-of-the-valley, sword fern, foam flower and lady fern. A wide variety of mosses and liverworts are found in most riverine forests.

For a more thorough treatment of the riverine forest one should consult, a publication by Cordes (1972) on this subject.

## F. DISTURBED AREAS

The Disturbed Area category is interzonal in scope, being applicable to both the Coastal and Interior zones. Of the two, by far the greatest area of disturbed vegetation is found in the Interior Zone, however the greatest variety of disturbance is found in the Coastal Zone. Three types have been recognized on the basis of the mode of disturbance: the logged type, other cleared areas, and the shell midden type.

Although the definition of types is based on the mode of disturbance, there is some unity, at least in general terms, in the resulting vegetation. This approach has resulted in a certain amount of generalization in the vegetation descriptions, particularly in the second type where a number of different habitats are included within the type. However, this is not considered to be an important limitation since the area included within this type is quite small. Post-disturbance vegetation in the logged type is considerably more uniform due to the fact that logged areas tend to have similar habitat conditions, since only the more highly productive sites with trees of commercial size have been logged. Logged areas are primarily on the  $C_1$  and the better  $C_2$  sites as well as  $G_1$  sites to a lesser extent. The shell midden type is definitely a distinct disturbed vegetation type because shell middens provide a specific recurring set of environmental conditions.

A good description of the history of disturbance on the West Coast Trail can be found in Byrne's 1973 report on the area.

### F<sub>1</sub> The logged type (L)

Five different areas of the Park have been logged in the past: the Indian Reserves at Pachena Bay and the east side of Nitinat Lake, the beach plains at Clo-oose, the northwest side of Port San Juan including



sites along the Gordon River, and several small sections of Cape Beale. The Cape Beale disturbance was carried out to acquire poles for the telegraph line which was run between the town of Bamfield and the Cape Beale lighthouse. At Clo-oose, a large section of the beach plain was subdivided and cleared by the West Coast Development Company in 1910 for the purpose of creating a new Canadian resort area, but was subsequently abandoned. All the other areas were logged for commercial timber production. Logging has been of the clearcut or occasionally the selective variety, and no seeding or replanting has been done, so that seral succession has depended on the regeneration or invasion of native species and has been strongly influenced by site conditions.

On the moist, well-drained sites it appears that western hemlock seeds in almost immediately as a primary successional tree species. The largest such area is on the shore of Port San Juan and supports a dense young hemlock forest with little shrub growth, which at first glance does not appear to have been disturbed. In amongst the hemlock, however, old rotten stumps up to six feet in diameter can easily be seen. Notches in the stumps at about four feet above ground level where support boards were inserted for loggers to stand on while felling the trees are also visible. A similar stand of hemlock is located at the abandoned resort townsite at Clo-oose. In cases where logging took place many years ago, and where a closed forest has subsequently developed, mapping symbols representing both the logged type and the present forest type have been placed on the map. An example would be:  $F_1(C_1)$ .

Less well-drained areas which have advanced to the tree stage of succession often contain large amounts of redcedar in the canopy, as do those logged areas situated on interior rock knolls on Cape Beale. Rich

Figure 35. Logged area near Brown Cove, Nitinat Lake. Natural regeneration is primarily western hemlock.

Figure 36. Dense growth of salmonberry, thimbleberry and elderberry on an abandoned homestead at Whyak (near Nitinat narrows). Whyak, an old Indian village,, has numerous midden deposits,

mineral soils along the Gordon and Pachena Rivers support abundant red alder less than forty feet in height. Alder are also characteristic of abandoned logging roads where they often remain in pure, dense stands.

The most recently logged area is the Pachena Bay Indian Reserve, and it is **still very** open. Shrubs such as salmonberry, salal, red huckleberry and blueberries predominate in this area. These same species tend to dominate the low shrub layer in all logged areas while the tall shrub layer is much more variable, although it usually includes large amounts of hemlock with varying numbers of redcedar, red alder, Pacific crab apple and Vaccinium spp,

The herb layer of the more open sites usually contains large amounts of fireweed (Epilobium angustifolium). Other typical herbs include wild 'lily-of-the-valley, deer fern, bracken and bunchberry. Skunk cabbage and Juncus effusus may be quite abundant on moist sites such as in the logged site along the trail to Brown's Cove on Nitinat Lake. Weed species such as Hypochaeris radicata and pearly everlasting (Anaphalis margaritacea) are frequent near areas of recent or current human habitation.

A more detailed study of the logged areas would undoubtedly reveal a much more complex series of successional stages and community types, but is beyond the scope of the present study.

## F<sub>2</sub> Other cleared areas (D)

This type includes, with the exception of the shell middens, all cleared or otherwise disturbed areas which are not the direct result of logging. Among such areas are abandoned homesteads, sand blowouts, and the trail itself. Currently inhabited areas such as the lighthouses and remaining homes at Clo-oose and Whyak were not considered in the vegetation survey and are not included here.

Weed species are common wherever disturbance has occurred. On sandy soils and the drier areas the most frequent weed species are Hypochaeris radicata (cat's ear), ox-eye daisy (Chrysanthemum Leucanthemum), tansy (Tanacetum douglasii), fireweed (Epilobium angustifolium), sheep sorrel (Rumex acetosella) and velvet grass (Holcus lanatus). Moister sites with rich soils often support brome grass (Bromus vulgaris), creeping buttercup (Lianunculus repens), hop clover (Trifolium dubium), self heal (Prunella Vulgaris), English plantain (Plantago lanceolata), Kentucky bluegrass (Poa pratensis) and a variety of mustards.

Abandoned homesteads generally have been vacated for a sufficient period of time to allow dense shrub growth to cover those sites; many of the old houses at Clo-oose are surrounded by virtually impenetrable walls of salal and salmonberry. These old homesteads are also the site of most of the ornamental species discovered in the survey-. Flowers such as day lily (Hemerocallis sp.), hydrangea (Hydrangea macrophylla), rocket, (Hesperis sp.) and poppies (Papaver sp.) still survive near old garden plots but will no doubt eventually be eliminated by native species. Ornamental trees and shrubs are not common, however English holly and a horticultural variety of rose bush were found growing at Whyak, while there is an obviously planted broad-leaved maple tree (Acer macrophyllum) outside the old post office in Clo-oose.

Two major sand blowouts were discovered, both the result of manmade clearings in the beach shrub fringe area. The largest of these is at Clo-oose, and is the site of the old golf course, which was apparently destroyed during a severe storm and subsequently denuded of its artificial vegetation. Today this area supports a vegetation very similar to the "Aira slacks" and Poa blowout" subcommunities of the Wickaninnish sand

dunes (see Bell, 1972 ) but is on flat topography. Plant growth is very sparse, but includes Aira praecox (little hairgrass), Poa macrantha (seashore bluegrass), beach silvertop (Glehnia leiocarpa), black knotweed (Polygonum paronychia), mace-headed sedge, yellow sand verbena (Abronia latifolia) and beach morning-glory (Convolvulus soldanella ). Most of the xeric weed species are also present. This blowout is an excellent example of man-induced change in the environment and could well be used for interpretive purposes. The disruption caused by hikers to the forward edge of the blowout probably has the effect of maintaining the area in the early stages of succession; this may or may not be considered desirable. Construction of a boardwalk would help eliminate this effect. The other sand blowout is located on Kēeha Beach and may once have been a helicopter landing pad. It is not easily accessible,

The third major disturbed community in this type is found along the trail and consists of a variety of herb species. Many of them are flowering plants, and are apt to be the species which the average hiker will notice and wonder about. The most common trailside wildflowers include wild lily-of-the-valley, lace or foam flower (Tiarella trifoliata), bunchberry, twisted stalk (Steptopus amplexifolius), fringe cups (Tellima grandiflora), youth-on-age (Tolmiea menziesii), Boykinia elata and slender bog orchid (Habenaria saccata). The best example of this trailside community of herbs is found along the first four miles of the north end of the trail. After this the trail passes through a series of dense shrub types and herbs are no longer as common.

### F<sub>3</sub> The shell midden type (SM)

The West Coast Trail section of the coast, was once the stronghold of the Nitinat Indians: major villages existed at Whyak, Clo-oose, Tsusiat Lake, Carmanah Point and Tsuquadra, and temporary fishing stations were scattered along the coastline. (Byrne, 1973). At each of these sites the accumulation of mollusc shells, animal remains, ashes and other refuse gradually resulted in the formation of mound-shaped cultural deposits, or shell middens. Today, the most recently abandoned middens support very characteristic dense shrub and weed communities, easily visible on aerial photographs. Invasion by neighboring forest types occurs rapidly, however, and many of the middens have been overgrown by trees and are not easily recognizable.

Five readily recognizable midden sites occur on or near the trail. The most extensive of these is at Whyak, on the Nitinat Narrows, and consists of at least three large middens which are in early stages of succession. One of the middens supports a number of cabins and is overgrown with domestic and cultivated plants, but the other two epitomize midden type vegetation very well. Like all middens, they are located on sheltered beaches in and behind the driftwood zone, but in front of the spruce-salal forest type, so that they represent a variant of the red alder - salal shrub fringe. Tree cover, limited to a few encroaching Sitka spruce, is minimal; the vast bulk of the vegetation is composed of an impenetrable mass of deciduous shrubs. A wide variety of weeds, forest and beach herbs are present around the periphery of the middens, and in those places where pathways cut through them.

There appear to be fundamental differences between the species compositions of the West Coast Trail and Broken Group Islands middens.

Figure 37. An example of the shell midden type Located between Nitinat narrows and Klanawa River. Sitka spruce has been gradually encroaching on this site for 100 years of more. Unless some kind of management is initiated, the herb and shrub-covered midden will gradually be overrun by the forest.

While Pacific ninebark (Physocarpus capitatus) and red elderberry dominate the shrub layers of the island middens (Bell and Harcombe, 1973), neither of these shrubs is abundant on the Phase III middens: ninebark was only encountered on one occasion. Instead, black twinberry inevitably dominates the tall shrub layer, and is codominant in the low shrub layer with Nootka rose, salmonberry or thimbleberry. The most extensive stands of Nootka rose and thimbleberry in this entire section of the Park are located on middens. Red elderberry is fairly common as an "emergent" in the tall shrub layer near the forest margin, but may be completely absent on the drier middens. Seepage sites usually support red alder and stink currant. Since the middens of the Broken Group Islands and the West Coast Trail area are very close in terms of age and extent of development, it is probable that the species differences reflect habitat differences, rather than successional stages in midden vegetation.

There are minor differences between the herb layers of the middens, as well.. Stinging nettle (Urtica dioica) typifies the Broken Group Islands middens, but is seen only at the Indian Resnrve on Bamfield Inlet in the West Coast Trail section of the Park. Other than this, however, species composition is very similar: rare grasses such as Dactylis glomerata (Orchard grass) and Danthonia californica (California oatgrass) are found on middens, as are the weed species Bromus vulgaris (brome grass), Holcus lanatus (velvet grass), Phleum pratense (timothy), Hordeum brachyantherum (meadow barley) and Lolium perenne (perennial ryegrass). The more common and conspicuous herbs include beach rye, hedge nettles (Stachys spp.), giant vetch, giant figwort (Scrophularia californica), beach pea and yarrow. Eurhynchium oreganum is the most frequent moss.



Shell middens are a unique feature of Pacific Rim National Park, both in terms of vegetation and the archaeological features with which they are usually associated. It is, of course, impossible to preserve them in their present state since they are undergoing dynamic successional vegetation changes and will eventually be reclaimed by the forest. Every effort should be made, however, to minimize disruption of the middens and prevent vandalism of the remaining Indian dwellings, petroglyphs and burial sites.

### AREAL EXTENT OF VEGETATION TYPES

The area covered by each of the classification units (zones, subzones and vegetation types) is given in Table 9. Both actual area (acres) and relative values (per cent) are given. Of the two zones, the Interior Zone is by far the largest covering 87.4% of the Phase III area as compared to 8.6% for the Coastal Zone. However, the Coastal Zone with its twelve types has greater vegetation diversity than the Interior Zone where eight types are present.

The Coastal Plain Subzone of the Interior Zone accounts for 84.1% of the vegetated area of Phase III. The two major tree species in this subzone, western redcedar and western hemlock cover approximately 85% of the total area. Western redcedar is the leading tree species, being dominant over 64% of the area while western hemlock is second with 24%. Sitka spruce, which appears so prominent to anyone hiking the trail, is the dominant tree species in slightly less than 5% of the vegetated area.

Some of the ecologically most interesting communities cover very small areas : each of the red fescue herb type, salal shrub type, beach rye herb type, red alder-salal shrub type, water lily type and shell midden type cover 0.1% or less of the total vegetated area<sup>1</sup>. Disturbed areas cover 4% of the area with the logged type accounting for most of this.

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<sup>1</sup> The acreages of some of these types may have been underestimated. The minimum mapping area was approximately one acre so that small or discontinuous patches of vegetation would not be included in the acreages. These patches may be an important part of the total acreage for some types such as the red fescue herb type.

Table 9. The Classification Units and Their Respective  
Acreages in the West Coast Trail Phase of  
Pacific Rim National Park.

	Area (Acres)	Per Cent of Total
COASTAL ZONE	2,633	8.6
<b>Rocky Headlands and Islands Subzone</b>	<b>345</b>	<b>1.1</b>
A <sub>2</sub> Red fescue herb type (FrPm)	2	
A <sub>3</sub> Salal shrub type (GsLi)	8	
A <sub>4</sub> Spruce-salal forest (PsGsMd)	191	0.6
A <sub>5</sub> Redcedar-hemlock scrub forest (TpThGs)	144	0.5
Beeches, Near-Coast Terrees and Plains Subzone	2,175	7.0
B <sub>2</sub> Beach rye herb type (Em)	17	0.1
B <sub>3</sub> Red alder-salal shrub type (ArGs)	18	0.1
B <sub>4</sub> Spruce-salal forest (PsGsPs)	368	1.2
B <sub>5</sub> Spruce-sword fern forest (PsRsPm)	529	1.7
B <sub>6</sub> Hemlock-spruce forest (ThPs)	1,262	4.1
Tidal Flat Subzone	113	0.4
E <sub>1</sub> Tufted hairgrass type (DcSv)	113	0.4
INTERIOR ZONE	27,122	87.6
Coastal Plain Subzone	26,081	84.1
C <sub>1</sub> Hemlock-deer fern forest (ThBs)	5,526	17.8
C <sub>2</sub> Cedar-hemlock forest (TpTh)	14,260	46.0
C <sub>3</sub> Cedar muskeg forest (Tp)	5,525	17.8
C <sub>4</sub> Shore pine bog forest (Pc)	482	1.6
C <sub>5</sub> Sphagnum bog type (SpLg)	259	0.0
C <sub>6</sub> Water lily type (Np)	29	0.1
Rock Outcrop Subzone	809	2.6
D <sub>1</sub> Hemlock-shore pine scrub forest (ThPc)	809	2.6
Riverine Subzone	232	0.7
G <sub>1</sub> Spruce-hemlock forest (PsTh)	232	0.7
DISTURBED AREAS	1,247	4.0
F <sub>1</sub> Logged type (L)	1,207	3.9
F <sub>2</sub> Other cleared areas (D)	33	0.1
F <sub>3</sub> Shell midden type (SM)	7	
TOTAL	31,002	

Figure 38. Beach morning-glory (Convolvulus soldanella).

## CHAPTER V

## 'THE VASCULAR PLANT FLORA

Two hundred and ninety-one species of vascular plants representing a total of 61 families were collected in the West Coast Trail phase of Pacific Rim National Park'. Of these, 55 are new to Pacific Rim Park as a whole; in other words, they have not been found in either of the other two phases. Forty-four species have been introduced into North America while seven have escaped from flower or vegetable gardens. The garden escapees are not naturalized species and most, if not all, will be gradually eliminated by competition from native species. Many of the introduced species, however, are well-adapted weeds and will continue to flourish, especially in disturbed areas.

The gymnosperms contribute most heavily to the total biomass of the environment as the dominants of the forested areas; western hemlock and western redcedar, respectively, are the most abundant of the forest trees. Shrubs are a conspicuous element of most communities. The ericaceous species are the most abundant, and the commonest among these are salal, Vaccinium spp. (blueberries and huckleberries), false azalea, bog laurel and Labrador tea. Salmonberry is the only abundant non-ericaceous shrub. Herb vegetation is often relatively sparse in the forested areas due to the density of the tree canopy, so that shade-tolerant species such as false lily-of-the-valley, deer fern and sword fern are the most frequent.

While the commonest and most widespread plants provide an overall impression of the vegetation and are the most practical for use in characterizing community types, it is the less widely distributed species with

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<sup>1</sup> During the vegetation survey, only uninhabited areas were studied; the lighthouse reserves and the few remaining inhabited parts of Whyak and Clo-oose were not examined.

Figure 39. Lady fern (Athyrium filix-femina) on the bank of the Klanawa River.

specialized habitat requirements which contribute variety and reflect subtle variation in the environment. The rarest of the species normally have exacting habitat requirements and are indicative of specific environmental conditions; for this reason, they are often the most interesting of the plants. For example, among the 48 species classified as "rare" is a group of subalpine plants which would not normally be expected near sea level. These include Epilobium alpinum (alpine willowherb), Osmorhiza purpurea (purplish sweet cicely) and Valeriana sitchensis. Their occurrence seems to coincide with the existence of extreme environmental conditions (severe exposure; thin, rocky soil) which, in effect, duplicates the subalpine environment to which the plants are adapted. In general, most of the rarer species are herbs, since it is the herbs which contribute the greatest number of species to the Park's flora. The grass family, alone, has 37 members.

With 291 species, the Phase III flora is intermediate in flora diversity between Long Beach and the Broken Group Islands - this can probably be explained by the degree of habitat diversity. Long Beach, due to its larger area and history of human disturbance, has the greatest habitat variety of the three Phases and, therefore, supports the most varied flora (338 species). The Broken Group Islands phase has the Least diverse flora (231 species) apparently due to Limited areal extent, Lack of human influence and Less diverse environmental conditions. Of the 55 species restricted to Phase III, most are found on a variety of riverine habitats and disturbed sites. The total vascular flora for all three phases of the Park now stands at 441 species. A schematic diagram showing the distribution of species among the three Phases is presented in Figure 40.

For the sake of continuity, the annotated species list follows the same format as that, employed in the reports on Phases I and II. The common names, abundance, distribution and habitat preferences for each species are given in the brief accompanying paragraph, along with points of special interest. The parenthetical notation following the annotation refers to the vegetation types in which the species most commonly occurs; the complete names of these types are given in the descriptions of the vegetation types and in Table 3. The descriptions of vegetation types should be referred to for more information on habitat, controlling environmental influences and associated species.

Nomenclature follows Hitchcock et al (1955-1969), except where noted. Introduced species are designated with an apostrophe ('), species new to the total Pacific Rim flora are marked with an asterisk (\*), and ornamental species are **Listed** separately at the end of the chapter.



Total Flora of Pacific Rim National Park: 441 Species

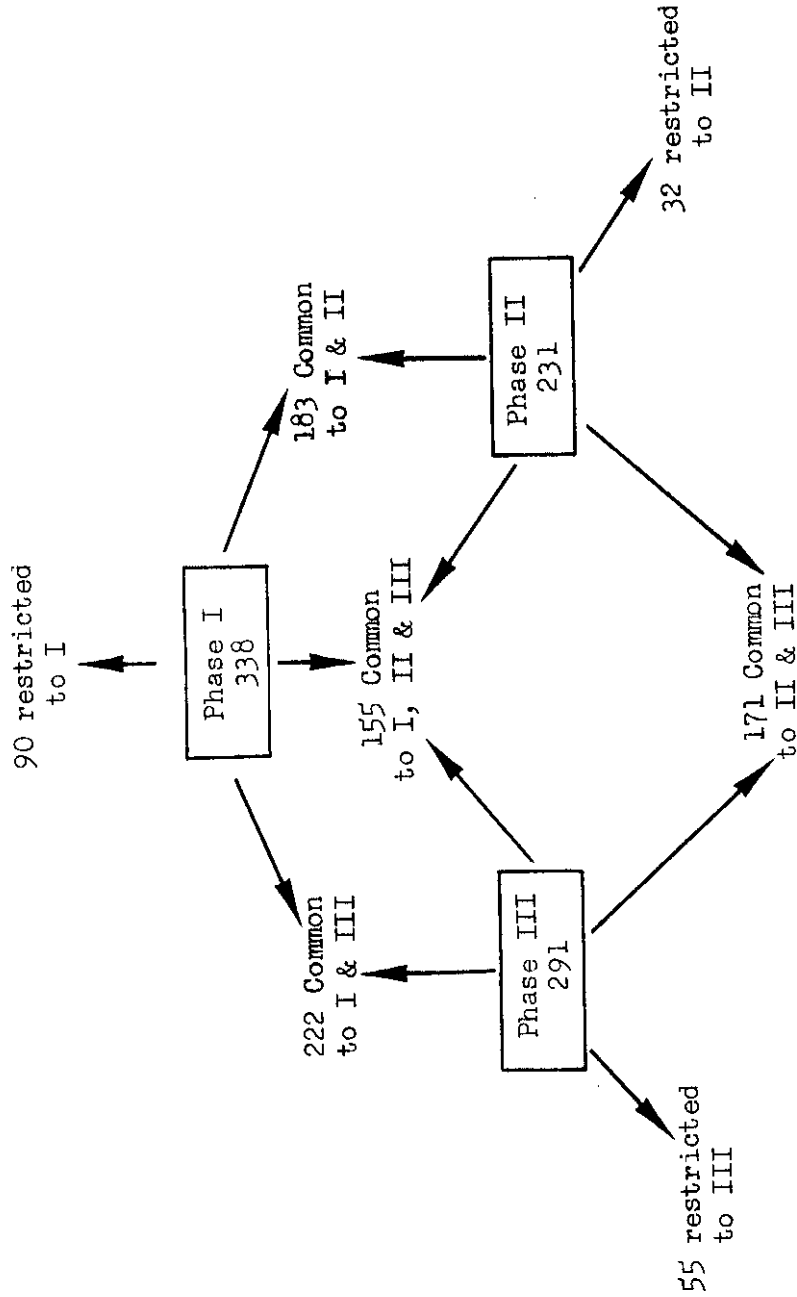


Figure 40. Species distribution for the three Phases of Pacific Rim National Park. Roman numerals indicate the three Phases while Arabic numerals indicate the number of species.

FLORA OF THE WEST COAST TRAIL  
(PHASE III, PACIFIC RIM NATIONAL PARK)

Those species not previously found in Phases I or II are marked with an asterisk (\*). A total of 291 species were collected, 55 of which were new to the total floral inventory for the Park.

DIVISION LYCOPODIOPHYTA

Lycopodiaceae

Lycopodium clavatum L.  
Lycopodium inundatum L.

Selaginellaceae

Selaginella wallacei Hieron

DIVISION EQUISETOPHYTA

Equisetaceae

Equisetum arvense L.  
Equisetum hyemale L.  
Equisetum palustre L.  
Equisetum telmateia Ehrh.

DIVISION POLYPODIOPHYTA

Polypodiaceae

Adiantum pedatum L.  
Asplenium trichomanes L.  
Athyrium filix-femina (L.) Roth  
Blechnum spicant (L.) With.  
Dryopteris austriaca (Jacq.) Woynar  
Polypodium glycyrrhiza D. C. Eaton  
Polypodium scolieri Hook. & Grev.  
Polystichum munitum (Kaulf.) Presl  
Pteridium aquilinum (L.) Kuhn

DIVISION SPERMATOPHYTA

CLASS GYMnosPERMAE

Taxaceae

Taxus brevifolia Nutt.

## Cupressaceae

Thuja plicata Donn.

## Pinaceae

Abies amabilis (Dougl.) ForbesPicea sitchensis (Bong.) Carr.Pinus contorta Dougl. ex Loud. var. contortaPinus monticola Dougl. ex D. DonTsuga heterophylla (Raf.) Sarg.

## CLASS ANGIOSPERMAE

## MONOCOTYLEDONS

## Juncaginaceae

- \* Triglochin concinnum Davy var. concinnum
- Triglochin maritimum L.

## Potamogetonaceae

Potamogeton epihydrus Raf.Potamogeton gramineus L.Potamogeton natans L.

## Zosteraceae

Phyllospadix spp. (probably both scouleri Hook and torreyi Wats.)Zostera marina L.

## Juncaceae

Juncus balticus Willd.Juncus bufonius L.Juncus effusus L.Juncus ensifolius Wikst.Juncus falcatus E. Meyer

- \* Juncus Lesueurii Boland.

Juncus supiniformis Engelm.

- \* Juncus tenuis Willd.

Luzula campestris (L.) DC.Luzula parviflora (Ehrh.) Desv.

## Cyperaceae

Carex lenticularis Michx.Carex livida (Wahl.) Willd.Carex lyngebyei Hornem.Carex macrocephala Willd. ex Spreng.

- \* Carex mertensii Prescott ex Bong.

Carex obnupta L. H. Bailey

## Cyperaceae, Cont'd.

- Carex phyllomanica W. Boott. in Wats.  
Carex pluriflora Hultén  
Carex rostrata Stokes ex With.  
Carex sitchensis Prescott in Bong.  
Dulichium arundinaceum (L.) Britt.  
Eleocharis palustris (L.) R. & S.  
Eriophorum polystachion L.  
Rhynchospora alba (L.) Vahl  
Scirpus americanus Pers.  
Scirpus cernuus Vahl  
Scirpus cespitosus L.  
Scirpus microcarpus Presl  
\* Scirpus validus Vahl

## Gramineae

- \* Agropyron repens (L.) Beauv.  
Agrostis aequalis (Trin.) Trin.  
Agrostis alba L.  
Agrostis exarata Trin.  
Agrostis tenuis Sibth.  
Aira praecox L.  
Anthoxanthum odoratum L.  
\* Bromus erectus Huds.  
Bromus mollis L.  
\* Bromus pacificus Shear  
Bromus sitchensis Trin.  
Bromus vulgaris (Hook.) Shear  
Calamagrostis crassiglumis Thurb.  
\* Calamagrostis inexpansa Gray (hybrid with CC. crassiglumis ?)  
Calamagrostis nutkaensis (Presl) Steud.  
Dactylis glomerata L.  
Danthonia californica Boland.  
Deschampsia cespitosa (L.) Beauv.  
Deschampsia elongata (Hook.) Monro ex Benth.  
\* Deschampsia holciformis Presl (Hitchcock lumps this with D. cespitosa)  
Distichlis spicata (L.) Greene  
Elymus glaucus Buckl.  
Elymus hirsutus Presl  
Elymus mollis Trin. in Spreng.  
\* Festuca anagalura Nutt.  
Festuca rubra L.  
Festuca subulata Trin. in Bong.  
Holcus lanatus L.  
Hordeum brachyantherum Nevski  
Lolium perenne L.  
\* Melica subulata (Griseb.) Scribn.  
\* Panicum pacificum Hitch. & Chase (Hitchcock lumps this with P. occidentale)

## Gramineae, Cont'd.

Phleum pratense L.Poa macrantha VaseyPod pratensis L.\* Puccinellia pumila (Vasey) Hitch.Trisetum cernuum Trin.

## Araceae

Lysichitum americanum Hultén & St. John

## Liliaceae

Allium cernuum Roth in RoemerErythronium revolutum SmithMaianthemum dilatatum (Wood.) Nels. & Macbr.Streptopus amplexifolius (L.) DCTofieldia glutinosa (Michx.) Pers.\* Trillium ovatum Pursh

## Iridaceae

Sisyrinchium angustifolium Mill.Sisyrinchium californicum (Ker-Gawl.) Dryand.

## Orchidaceae

\* Habenaria dilatata (Pursh) Hook.\* Habenaria hyperborea (L.) R. Br. in Ait.Habenaria saccata Greene

## DICOTYLEDONS

## Salicaceae

Salix hookeriana Barratt in Hook.\* Salix scouleriana Barratt in Hook. (S. sitchensis Sanson in Bong. is probably present)

## Myricaceae

Myrica gale L.

## Betulaceae

Alnus rubra Bong.

## Urticaceae

Urtica dioica L.

## Loranthaceae

Arceuthobium campylopodum Engelm.

## Polygonaceae

- \* Polygonum aviculare L.
- Polygonum paronychia Cham. & Schlecht.
- \* Polygonum persicaria L.
- Rumex acetosella L.
- Rumex crispus L.
- Rumex obtusifolius L.

## Chenopodiaceae

Atriplex patula L.  
Chenopodium sp. (probably album L., but no inflorescence was present)  
Salicornia virginica L.

## Nyctaginaceae

Abronia latifolia Eschsch.

## Portulacaceae

Montia parvifolia (Moc.) Greene  
Montia sibirica (L.) Howell

## Caryophyllaceae

- Cerastium viscosum L.
- Honkenya peploides (L.) Ehrh.
- Sagina crassicaulis Wats.
- Sagina procumbens L.
- \* Spergularia canadensis (Pers.) G. Don
- Spergularia rubra (L.) J. & C. Presl
- Stellaria crispa Cham. & Schlecht.

## Nymphaeaceae

- \* Brasenia schreberi Gmel.
- Nuphar polysepalum Engelm.

## Ranunculaceae

Aquilegia formosa Fisch. in DC.  
Coptis asplenifolia Salisb.  
Ranunculus flammula L.  
Ranunculus repens L.  
Ranunculus uncinatus D. Don  
Trautvettaria caroliniensis (Walt.) Vail

## Cruciferae (Brassicaceae)

- Arabis glabra (L.) Bernh.  
Brassica campestris L.  
 \* Brassica juncea (L.) Coss.  
Cakile edentula (Bigel.) Hook.  
 \* Cardamine breweri Wats. var. orbicularis (Greene) Detl.  
Cardamine occidentalis (Wats.) Howell  
 \* Sisymbrium officinale (L.) Scop.

## Droseraceae

- Drosera anglica Buds.  
Drosera rotundifolia L.

## Crassulaceae

- Sedum sp. (most Likely oreganum Nutt., but could be spathulifolium Hook.;  
 no flowers)

## Saxifragaceae

- Boykinia elata (Nutt.) Greene  
Heuchera micrantha Dougl. ex Lindl.  
Tellima grandiflora (Pursh) Dougl.  
Tiarella laciniata Hook.  
Tiarella trifoliata L.  
 \* Tolmiea menziesii (Pursh) T. & G.

## Grossulariaceae

- Ribes bracteosum Dougl. ex Rook.  
Ribes divaricatum Dougl.  
 \* Ribes lacustre (Pers.) Poir.

## Rosaceae

- Amelanchier alnifolia Nutt.  
Aruncus sylvester Kostel.  
Fragaria chiloensis (L.) Duchesne  
Geum macrophyllum Willd.  
Holodiscus discolor (Pursh) Maxim.  
Physocarpus capitatus (Pursh) Kuntze  
Potentilla pacifica Howell  
 \* Potentilla palustris (L.) Scop.  
Potentilla villosa Pall. ex Pursh  
Pyrus fusca Raf.  
Rosa nutkana Presl  
 \* Rubus idaeus L.  
Rubus laoniatus Willd.  
Rubus leucodermis Dougl. ex T. & G.  
Rubus parviflorus Nutt.

## Rosaceae, Cont'd.

- \* Rubus pedatus J. E. Smith
- Rubus procerus Muell.
- Rubus spectabilis Pursh
- Rubus ursinus Cham. & Schlecht.
- Sanguisorba officinalis L.
- Spiraea douglasii Hook.

## Leguminosae (Fabaceae)

- Cytisus scoparius (L.) Link
- Lathyrus japonicus Willd.
- \* Lathyrus palustris L.
- Trifolium dubium Sibth
- Trifolium repens L.
- Trifolium wormskjoldii Lehm.
- Vicia gigantea Hook.

## Callitrichaceae

- Callitriche heterophylla Pursh ex Darby
- \* Callitriche stagnalis Scop. (vegetative evidence only)

## Empetraceae

- Empetrum nigrum L.

## Aceraceae

- Acer macrophyllum Pursh

## Rhamnaceae

- Rhamnus purshiana DC.

## Hypericaceae

- Hypericum anagalloides G. & S.

## Violaceae

- Viola glabella Nutt. in T. & G.
- Viola palustris L.

## Onagraceae

- \* Epilobium alpinum L.
- Epilobium angustifolium L.
- \* Epilobium glandulosum Lehm.
- Epilobium watsonii Barbey in Brew. & Wats.



## Umbelliferae (Apiaceae)

- \* Angelica genuflexa Nutt. in T. & G. (vegetative only)  
Angelica lucida L.  
Conioselinum pacificum (Wats.) Coult. & Rose  
Glehnia leiocarpa Mathias  
Heracleum lanatum Michx.  
Lilaeopsis occidentalis Coult. & Rose  
Oenanthe sarmentosa Preslex DC.  
Osmorhiza chilensis H. & A.  
\* Osmorhiza purpurea (Coult. & Rose) Suksd.

## Cornaceae

- Cornus stolonifera Michx.  
Cornus unalaschkensis Ledeb.

## Ericaceae

- Arctostaphylos uva-ursi (L.) Spreng.  
Gaultheria shallon Pursh.  
Hypopitys moCrantza  
Kalmia polifolia Wang.  
Ledum groenlandicum Oeder  
Menziesia ferruginea Smith  
Pyrola uniflora L.  
\* Pyrola secunda L.  
Vaccinium alaskaense Howell  
Vaccinium ovalifolium Smith  
Vaccinium ovatum Pursh  
Vaccinium oxycocous L.  
Vaccinium parvifolium Smith in Rees  
Vaccinium vitis-idaea .

## Primulaceae

- Dodecatheon jeffreyi van Houtte  
Trientalis arctica Fisch. ex Hook.

## Plumbaginaceae

- Armeria maritima (Mill.) Willd.

## Gentianaceae

- Gentiana douglasiana Bong.  
Gentiana sceptrum Griseb. in Hook.

## Menyanthaceae

- Menyanthes trifoliata L.  
Nephrrophyllum crista-galli (Menzies) Gilg.

## Convolvulaceae

Convolvulus soldanella L.

## Labiatae(Lamiaceae)

- \* Glecoma hederacea L.
- Mentha arvensis L.
- Prunella vulgaris L.
- \* Stachys coolyae Heller
- Stachys mexicana Benth.

## Scrophulariaceae

- Castilleja miniata Dougl. ex Hook.
- Digitalis purpurea L.
- Mimulus guttatus DC.
- Scrophularia californica Cham. & Schlecht.
- Veronica americana Schwein. ex Benth.
- \* Veronica arvensis L.
- \* Veronica scutellata L.

## Orobanchaceae

Boschniakia hookeri Walpers

## Lentibulariaceae

- \* Utricularia vulgaris L.
- Pinguicula vulgaris L.

## Plantaginaceae

Plantago lanceolata L.  
Plantago macrocarpa Cham. & Schlecht.  
Plantago major L.  
Plantago maritima L.

## Rubiaceae

Galium aparine L.  
Galium triflorum Michx.

## Caprifoliaceae

Linnaea borealis L.  
Lonicera involucrata (Rich.) Banks ex Spreng.  
Sambucus racemosa L.  
Symphoricarpos albus (L.) Blake  
Viburnum edule (Michx.) Raf.

## Valerianaceae

Valeriana sitchensis Bong.

## Campanulaceae

Lobelia dortmanna L.

## Compositae (Asteraceae)

Achillea millefolium L.Ambrosia chamissonis (Less.) GreeneAnaphalis margaritacea (L.) B. & H.Apargidium boreale (Bong.) T. & G.\* Arctium minus (Hill) Bernh.\* Arnica amplexicaulis Nutt.Artemisia suksdorfii PiperAster subspicatus NeesBellis perennis L.Chrysanthemum leucanthemum L.\* Cirsium edule Nutt.Cirsium vulgare (Savi) Airy-Shaw\* Crepis capillaris (L.) Wallr.Hieracium albiflorum Hook.Hypochaeris radicata L.Lactuca muralis (L.) Fresen.\* Petasites frigidus (L.) Fries\* Prenanthes alata (Hook.) D. Dietr.Semeribo sylvaticus L.Solidago canadensis L.Sonchus asper (L.) HillTanacetum douglasii DC.\* Tanacetum vulgare L.Taraxacum officinale Weber

## ORNAMENTALS

Found growing as garden escapes or around abandoned buildings. Inhabited areas were not sampled.

- \* Arrhenatherum elatius (L.) Presl (Gramineae)
- \* Hedera helix L. (Araliaceae)
- \* Hemerocallis sp. L. (Liliaceae)
- \* Hesperis Sp. L. (Cruciferae)
- \* Hydrangea macrophylla Ser. (Saxifragaceae)
- \* Ilex aquifolium L. (Aquifoliaceae)
- \* Papaver sp. L. (Papaveraceae)

## ANNOTATED CHECKLIST OF VASCULAR PLANT FMRA

## DIVISION LYCOPODIOPHYTA - CLUBMOSES AND SPIKEMOSSES

## LYCOPODLACEAE - CLUBMOSS FAMILY

Lycopodium clavatum L. n g clubmoss)

Sparse in the park and restricted to dry, well-drained areas. Most abundant on Cape Beale, where it forms spreading mats in the Logged areas, and along trailsides. Interior rock outcrops and the drier portions of pine bog forests are other typical habitats. (L, TpPc, Pc).

Lycopodium inundatum L. (Bog clubmoss)

Rare; found only on raised hummocks in pine bog forests and sphagnum bogs, where perennial herbs predominate. Most common in Cullite Bog and the pine bog forest between Walbran and Logan Creeks. (Pc, SpLg).

## SELAGINELLACEAE - SPIKEMOSS FAMILY

Selaginella wallacei Hieron (Wallace's spikemoss)

Rarely found; in loose mats on exposed rocky outcrops, where it grows with various mosses in crevices filled with dry soil and organic debris. Rocky headlands near the Port Renfrew trailhead showed the most extensive growths. (FrPm).

## DIVISION EQUISETOPHYTA - HORSETAILS

## EQUISETACEAE - HORSETAIL FAMILY

Equisetum arvense L. (Common horsetail)

Common; and growing in a variety of habitat types, mostly near stream or on seepage sites. Seen in the moister beach herb communities,

## EQUISETACEAE, Cont'd.

along streambanks, and in open areas of muskeg forests. (Em, PsTh, Tp).

Equisetum hyemale (Large ulring rush)

Less common than Equisetum arvense, and growing in drier habitats. Found in and behind the driftwood zone on Keeha Beach, and scattered along other sandy beaches for the Length of the Trail. (Em).

Equisetum palustre L. (Marsh horsetail)

Extremely rare; found only in gravel along the Klanawa River banks, where it was very scattered. (PsTh.)

Equisetum telmateia Ehrh. (Giant horsetail)

The most common horsetail in the area; growing in the same range of habitats as Equisetum arvense, but reaching up to four feet in height. There is an extensive stand on either side of the boardwalk about a mile from the Cape Beale Lighthouse. (Em, PsTh, Tp).

## DIVISION POLYPODIOPHYTA - FERNS

## POLYPODIACEAE - COMMON FERN FAMILY

Adiantum petatum (Northern maidenhair fern)

Scarce; but predictable on sheltered seepage cliffs, on steep streambanks in moist forests, and on protected faces of rocky outcrops. Fairly common for the first four miles along the Pachena Bay end of the Trail, where it grows on the steep inland side of the Trail with Aruncus Sylvester and Tolmiea menziesii. (FrPm, PsTh, TpTh).

## POLYPODIACEAE, Cont'd

Asplenium trichomanes L. (Maidenhair spleenwort)

Rare; found only on sheltered cliff faces at the Port Renfrew end of the Trail, where it grows with Adiantum pedatum. Asplenium viride Huds. may also be present, but was not encountered. (Em).

Athyrium filix-femina (L.) Roth (Lady fern)

Widespread in mature spruce and cedar-hemlock forests, and along streambanks. Generally indicative of cool, moist conditions. (PsGsPa, PsRsPm, PsTh).

Blechnum spicant (L.) With. (Deer fern)

The most widespread and abundant of the ferns. Although most common in moist coniferous forests situated on marine terraces or till, it is also found in logged and disturbed areas, on exposed rocky outcrops, and in interior scrubby forests. (ThBs, TpTh, Tp, ThPs, TpPc).

Dryopteris austriaca (Jacq.) Woynar (Spiny wood fern)

Scattered; growing in the moister climax forests, especially where amabilis fir is abundant. Primarily rooted in the mossy substrate covering decaying logs. (PsRsPm, ThPs, TpTh).

Polypodium glycyrrhiza D.C. Eaton (Licorice fern)

A common fern, epiphytic on trees or growing on moss-covered rocks. May grow epiphytically at considerable heights, and thus remain inconspicuous from ground level. Found in most forest types, and on rocky headlands in the spruce-salal fringe. Part of the P. vulgare complex. (ThBs, TpTh, PsGsPa, PsRsPm, PsGsMd).

## POLYPODIACEAE, Cont'd

Polypodium scolieri Hook. & Grev. (Leathery polypody)

Scattered but predictable along the immediate coast, where it grows on cliff faces or epiphytically on sitka spruce. Usually in sheltered habitat, but it may also grow in exposed conditions, where it is subject to the effects of ocean spray. (FrPm, GsLi, PsGsMd).

Polystichum munitum (Kaulf.) Presl (Sword fern)

Common in spruce and spruce-hemlock forests, where it may dominate the herb layer; favors moist, protected areas, and can thus be found under deadfall in logged or disturbed areas. (PsRsPm, ThPs, PsTh).

Pteridium aquilinum (L.) Kuhn (Bracken)

The most common fern in dry or exposed areas, such as rocky headlands, coastal shrub fringes, and logged or disturbed regions. (GsLi, ArGs, L, D).

## DIVISION SPERMATOPHYTA - SEED PLANTS

## CLASS GYMNOSPERMAE - CONIFERS

## TAXACEAE - YEW FAMILY

Taxus brevifolia Nutt. (Western yew)

Sporadic occurrence in muskeg forests, where it forms part of the tall shrub layer; also found in a very different environment as a component of the shrub zone on exposed rocky outcrops, in which case it exhibits a stunted, windswept growth form. Never abundant. (Tp, GsLi).

## CWRESSACEAE - CYPRESS FAMILY

Thuja plicata Donn. (Western red cedar)

Abundant; as a codominant with hemlock, it forms the **most** widespread forest type in the region. Moist inland marine terraces support the majority of the cedar, and maximum growth is seen in these areas. Scrubbier growth forms are seen under less **ideal** conditions on exposed rocky outcrops, interior rock outcrops, and in muskeg and bog forests. (TpTh, Tp, Pc, TpThGs, TpPc).

## PINACEAE - PINE FAMILY

Abies amabilis (Dougl.) Forbes (Amabilis fir, Pacific silver fir)

Common as a codominant with hemlock in mature hemlock forests, and as a component of spruce-hemlock riverine forests, A highly shade tolerant species which grows on interior deep soil zones or marine terraces, but never on the immediate coast. (ThBs, PsTh, ThPs).

Picea sitchensis (Bong.) Carr. (Sitka spruce)

Abundant; dominates the immediate coastline, where the effects of wind and ocean spray shape it into a **Krummholz-like** forest; **more** erect form is assumed as distance from the ocean increases. Spruce is **also** found in conjunction with hemlock on inland sites which feature enriched organic soils, such as marine terraces and watercourse floodplains. (PsGsMd, PsGsPa, PsRsPm, ThPs, PsTh).

Pinus contorta Dougl. ex Loud var. contorta (Lodgepole pine, shore pine)

Scattered; occurs in **muskeg** forests, dominates the pine bog communities, and is also common on interior rock outcrops. In **all** of these



PINACEAE, Cont'd.

habitats the species exhibits a stunted, round-crowned form typical of the variety contorta. (Pc, TpPc, Tp).

Pinus monticola Dougl. ex D. Don (Western white pine)

Scarce in the area, and occurring in a variety of habitat and community types. Most often found on medium to well-drained regosols, and most common on Cape Beale. (TpPc, TpThGs, Tp).

Tsuga heterophylla (Raf.) Sarg. (Western hemlock)

The most abundant tree species in the area; dominates the coastal forest as a whole in conjunction with red cedar, and also occurs as a codominant with spruce on floodplains and some marine terraces. **Hemlock** is found on a variety of site types, being excluded *only* from the most extreme in terms of dryness, exposure, or waterlogging; it is also the primary tree succession species on Logged areas in the park.

(ThBs, TpTh, PsTh, ThPs, TpThGs).

## CLASS ANGIOSPERMAE - FLOWERING PLANTS

### MONOCOTYLEDONS

#### JUNCAGINACEAE - ARROW-GRASS FAMILY

\* Triglochin concinnum Davy var. concinnum (Dwarf seaside arrow-grass)

Rare; only found at the head of Bamfield Inlet, growing below the high tide line on mudflats with Triglochin maritimum and Salicornia virginica. Fairly common at this location, but not encountered in any of the other estuaries. Flowering May-August. (DcSv).

JUNCAGINACEAE, Cont'd.

Triglochin maritimum L. (Seaside arrow-grass)

Common in the lower mudflat zones of salt marshes and estuaries, but not seen otherwise. (DcSv).

POTAMOGETONACEAE - PONDWEED FAMILY

Potamogeton epihydrus Raf. (Pondweed)

Fairly common in Kichha Lake on Cape Beale, where it is found with Nuphar senia, and the other Potamogeton species, but not collected otherwise. This species is distinguished by the air chambers which line either side of the midnerve on the submersed leaves and form a broad median stripe. (Np).

Potamogeton gramineus L. (Pondweed)

Found in Kichha Lake and the Tsusiat River, but less abundant in Kichha Lake than the other Potamogeton species. Lacks the median stripe on the submersed leaves that characterizes P. epihydrus. (Np).

Potamogeton natans L. (Common pondweed)

Common in the deeper waters of Kichha Lake, and in the small lake beside the trail to Brown's Cove, on the Nitinat Narrows. Also seen in the open bodies of water in a few of the larger sphagnum bogs, where it commonly occurs with Nuphar and Brasenia. (NP).

## ZOSTERACEAE - EEL-GRASS FAMILY

Phyllospadix scouleri Hook. (Surfgrass)  
Phyllospadix torreyi Wats.

The genus is abundant as an intertidal plant and also grows in many of the deeper tide pools. It often forms dense mats with Macrocystis on exposed beaches when it is washed ashore as flotsam. The lack of flowers or fruit on any of the collected specimens made identification to species impossible, but both P. scouleri and P. torreyi would be within range in this area,

Zostera marina L. (Eel-grass)

An abundant **subtidal** plant found off sheltered **rocky** shores and in protected inlets, where it forms dense beds. The Leaves are usually wider than those of Phyllospadix, and it is less common as flotsam.

## JUNCACEAE - RUSHFAMILY

Juncus balticus Willd. (Baltic rush)

**Relatively common** along the immediate **coast on moist** shingle beaches, on seepage **runnels** in sandy beaches, and in **estuarine** areas, where it grows in the fresh water **zone** with other rushes. (Em, DcSv).

Juncus bufonius L. (Toad rush)

Scattered; found on muddy, sparsely-vegetated lakeshores, in the fresh water zone of small estuaries, and along the Trail itself where standing water tends to **accumulate**. The only annual rush species in the Park. (Np, DcSv).

JUNCACEAE, Cont 'd.

Juncus effusus L. (Common rush)

The most common rush in the park, frequently growing along the side of the Trail. It is also very abundant around Kichha Lake, where it acts as a primary colonizer of the sphagnum mats around the margin of the Lake, stabilizing them so that other herbs and woody dicots may eventually invade to produce pine bogs. Usually present in Logged areas as well. Both var. compactus Lejeune & Court, and var. pacificus Fern. & Wieg. appear to be present, compactus dominating in the Logged areas.

(Np, Pc, L).

Juncus ensifolius Wikstr (Sickle-leaved rush)

*Fairly common* on seepage sites along the immediate coast, especially where streams drain into the ocean, as at Keeha Beach on Cape Beale. Inland occurrence is limited to moist roadside ditches near Pachena Bay, and those sphagnum bogs which are fairly close to the coast.

(Em, DcSv, SpLg).

Juncus falcatus E. Meyer (Sickle-Leaved rush)

Common, and found over the same range of habitats as J. ensifolius, with which it frequently grows. Fresh water seepage sites along the coast, and pools of *water* accumulated on sheltered rocky outcrops are the areas of most frequent occurrence. (DcSv, FrPm).

\* Juncus lesueurii Boland. (Salt Rush)

Present in most salt marshes on the immediate coast, and also occasionally found in the Elymus herb community where subsurface

## JUNCACEAE, Cont'd.

moisture is present. The two most extensive stands are in the salt marsh on Keeha Beach, and on the upper tidal flats near Squeaking Beach, Flowering June-July. (DcSv, Em).

Juncus supiniformis Engelm. (Hn.ir-Leaved rush)

Scarce; found around the shore of Xichha Lake, growing on sphagnum in some of the pine bogs, and in Cullite Bog. Most of the Cullite Bog specimens exhibited the growth of **bulblets** from the flowering heads.

Also known as J. oreganus Wats., a species not recognized by Hitchcock, et al (1969). (Np, SpLg, Pc).

\* Juncus tenuis Willd. (Slender rush)

Scarce; found only in the salt marsh on Keeha Beach, and at the mouths of the two creeks between Cribb's Point and Carmanah Creek. At **all** of these locations it was fairly common. Flowering June-August. (DcSv, PsTh).

Luzula campestris (L.) DC (Common Woodrush)

Scarce; found in **moist**, sheltered areas, such as at the base of seepage cliffs, where it may be found growing with Adiantum pedatum. Seems to be more common around the lighthouses, appearing almost like an introduced species. (PsTh, TpTh).

Luzula parviflora (Ehrh.) Desv. (Woodrush)

Rare; collected at the base of sheltered rock faces on the coast at Topaltas Bay. (FrPm).

## CYPERACEAE - SEDGE FAMILY

Carex lenticularis Michx.

Rare; found on the flooded bank of the Klanawa River, and in one wet lakeshore community on Kichha Lake. (NP, PsTh).

Carex livida (Wahl.) Willd. (Livid sedge)

Sporadic occurrence in sphagnum bogs and around the margin of Kichha Lake; appears to be most common in the bog situated between Walbran and Logan Creeks. (Np, SpLg).

Carex (Lyngbye's) sedge

A very common species, dominating the Lower estuarine areas, where it grows just above the Distichlis and Salicornia mudflats, usually in dense stands. It also grows on stabilized tidal flats at Topaltas Bay, and is scattered along the coastal herb communities where seepage sites occur. (DcSv, Em, FrPm).

Carex macrocephala Willd. ex Spreng. (Mace-headed sedge)

Common; but restricted to sand dunes, dry, sandy beaches and blowout areas, where it forms the vanguard of the vegetative community. A distinctive sedge with extensive, creeping rhizomes. (Em, D).

\* Carex mertensii Prescott ex Bong. (Mertens' sedge)

Rare; found only on the banks of Walbran and Logan Creeks, growing in moist gravel. Flowering May-July. (PsTh).

Carex obnupta L.H. Bailey (Slough Sedge)

The most common sedge in the park. Abundant in the estuaries above the standing water level; in sphagnum bogs and pine bog forests; at

## CYPERACEAE, Cont'd.

seepage sites in open forest types, and along the Trail where water tends to accumulate. (DcSv, Pc, SpLg).

Carex phyllomanica W. Boott in Wats. (Coastal stellate sedge)

Scattered occurrence in pine bog forests and as a pioneer species stabilizing the sphagnum mats around the margin of Kichha Lake. A member of the difficult C. stellulata complex. (Pc, SpLg, Np).

Carex pluriflora Hultén

Scarce. This attractive, delicate sedge is limited in occurrence to pine bog forests, where it grows rooted in the sphagnum mat, and to river estuaries, (notably the Cheewhat River estuary). (Pc, DcSv).

Carex rostrata Stokes ex With. (Beaked sedge)

Rare; found only in the pine bog situated between Walbran and Logan Creeks, and very scattered at this location. Growing on wet, exposed mud with C. (obn)ptac ) .

Carex sitchensis Prescott in Bong. (Sitka sedge)

Scarce; encountered on the stabilized sphagnum mats around Kichha Lake, in pine bog forests, and occasionally in sphagnum bogs. A colorful, distinctive sedge. (Pc, SpLg, Np).

Dulichium arundinaceum (L.) Britt. (Dulicheum)

Rare; discovered only near the southeast shore of Kichha Lake, where it was growing in shallow water with Scirpus validus. (Np).

## CYPERACEAE, Cont'd.

Eleocharis palustris (L.) R. & S. (Spike rush)

Rare; found only on the wet sandy beach at Cribb's Point, growing with Scirpus americanus well below the Elymus beach herb community, where both were exposed to salt spray and inundation during storms. (Em).

Eriophorum polystachion L. (Cotton grass)

Rare; only seen in Cullite Bog, where it is fairly common and conspicuous in late summer due to the cottony tufts of the perianth bristles. (Np).

Rhynchospora alba (L.) Vahl (Beak-rush)

Very abundant in sphagnum bogs; otherwise extremely rare. (SpLg).

~~Scirpus~~ Scirpus americanus - P e r s q u a r e )

Found only on the beach below Cribb's Point, where it was growing in large dense patches on the wet sand well below the Elymus herb community, and also in pools of brackish water trapped on the tidal flats. (Em).

Scirpus cernuus Vahl (Low club-rush)

Common at Bamfield Inlet, where it grows in dense clumps in the mud flats just above the Triglochin zone; otherwise seen only at Brown's Cove, growing along a fresh water rivulet draining into Nitinat Lake. (DcSv).

~~Scirpus~~ Scirpus fasciculatus L c l u b - r u s h )

Fairly common in all the sphagnum bogs, around the margin of Kichha Lake, and on wet, muddy portions of the Trail. (Np, SpLg).



## CYPERACEAE, Cont'd.

~~Scirpus~~ Scirpus macrocalpus Presl u i t e d bulrush)

Rare; found only on the flooded bank of the Klanawa River, growing on submerged, silty sand. (PsTh).

\* Scirpus validus Vahl (American great bulrush)

Growing abundantly around the margin of Kichha Lake, serving as the forerunner for the sphagnum mats which are advancing out into the lake and ultimately resulting in the formation of pine bog forests. This species is difficult to discern from S. acutus Muhl. ex Bigel., which is more robust and has larger spikelets. The colonial growth form of the Kichha Lake bulrush was more similar to that of S. acutus, but all the specimens collected were S. validus; further collecting might reveal the presence of both species. Flowering June-August. (Np).

## GRAMINEAE (POACEAE) - GRASS FAMILY

! \* Agropyron repens (L.) Beauv. (Quack grass)

Found only at the head of Bamfield Inlet, growing in a salt marsh situation with Elymus mollis above the sedge zone. Very tall, robust specimens. Flowering June-August. (DcSv)

Agrostis aequivalis (Trin.) Trin.

Rare; found only on an exposed bedrock outcrop on the southeast shore of Kichha Lake, growing in thin, moist organic debris with Carex obnupta and Anthoxanthum odoratum. (Tp).

## GRAMINEAE, Cont'd.

Agrostis alba L. (Redtop)

Scattered; growing rather abundantly in the salt marsh at the Cheewhat River, but otherwise found only on seepage sites near the coastal shrub fringe (Michigan Creek), or on the occasional rocky headland (Flat Rocks). Most specimens were var. palustris (Huds.) Pers. (DcSv, Em, FrPm).

Agrostis exarata Trin. (Spike bentgrass)

Scarce; found around the margin of Kichha Lake, and on seepage sites runnels behind the driftwood zone in shaded areas near Michigan Creek. (Np, Em).

' Agrostis tenuis Sibth. (Colonial bentgrass)

Found as a domestic escape near the Pachena Point Lighthouse, where it is apparently used as a lawn grass. (D).

Aira praecox L. (Hairgrass)

Fairly common in crevices on rocky headlands, in the dry transition zone on sandy south-facing beaches, and in blowouts. Usually growing with xerophytic mosses and Lichens. (FrPm, D).

' Anthoxanthum odoratum L. (Sweet vernalgrass)

Rare; found only on an exposed bedrock outcrop on the east shore of Kichha Lake, growing in moist organic debris with Juncus effusus and Holcus lanatus. (Tp).

'\* Bromus erectus Huds.

Very rare; found only twice on the moist rock shelf near Owen Point, growing with Mimulus guttatus. This species is a rather uncommon European introduction. Flowering June-July. (FrPm).

## GRAMINEAE, Cont'd.

' Bromus mollis L. (Soft cheat)

Rather rare; found only in a disturbed area at the head of Pachena Bay (an old campsite), and growing in moist crevices in the headland at Flat Rocks. (D, FrPm).

\* Bromus pacificus Shear (Pacific brome grass)

Rare; found only at the head of Pachena Bay, growing in open areas of the shrub fringe, or in the disturbed campground area. On moist, shaded sites; reaches a height of five feet. Flowering **May-July**. (ArGs, D).

Bromus sitchensis Trin. (Brome grass)

Found only at Keeha Beach, where it was growing in the beach transition zone in an open, sandy area just in front of the shrub fringe. This is a much drier habitat type than that of any of the other brome grasses. (Em).

' Bromus vulgaris (Hook.) Shear

Scarce; found in disturbed areas, such as the Pachena Bay campground; around the margins of shell middens; and in a few apparently undisturbed regions, such as the banks of the Klanawa River. (D, SM, PsTh).

Calamagrostis crassiglumis Thurb. (Thurber's reedgrass)

This rarely collected coastal grass was found in two locations in the study area: there is a fairly extensive stand in the small marsh on Keeha Beach; and the odd specimen occurs on the wet, gravelly banks of the Klanawa River. Also discovered in Phase II of the park (Bell and Harcombe, 1973), the rarity of this species may be partly due to the scarcity of collections from inaccessible areas of Vancouver Island. (PsTh, DcSv).

## GRAMINEAE, Cont 'd.

\* Calamagrostis inexpansa Gray (Narrow-spiked reedgrass)

A single specimen! collected from the banks of the Klanawa River, seemed to be intermediate between C. crassiglumis and C. inexpansa in ligule and inflorescence characteristics. It is most probably an anomalous specimen of C. crassiglumis, since C. inexpansa would be outside its range here, but further collecting is necessary to determine if indeed C. inexpansa or a hybrid type does exist in the area. (PsTh).

Calamagrostis nutkaensis (Presl) Steud. (Pacific reedgrass)

Common in the upper estuarine areas with Deschampsia cespitosa, and in muskeg and pine bog forests, especially around Kichha Lake. Also seen occasionally in the moister beach herb communities and rocky headlands. (DcSv, PC, Em).

! Dactylis glomerata L. (Orchard grass)

Rare; found only in the Pachena Bay campground and on shell middens at Whyak - disturbed, well-drained soils. (D, SM).

Danthonia californica Boland. (California oatgrass)

Rare; collected on a shell midden at Whyak, in a moist, sheltered area. Growing with introduced species such as Phleum pratense, and Holcus lanatus. (SM).

Deschampsia cespitosa (L.) Beauv. (Tufted hairgrass)

Abundant in the middle and upper estuarine zones; also common in pine bog forests, and often found in pockets of deeper soil on rocky headlands, and along the Trail at Pachena Point. Probably the most abundant grass in the area. (DcSv, PC, FrPm).

GRAMINEAE, Cont 'd.

Deschampsia elongata (Hook. ) Monro ex Benth. (Slender hairgrass)

Rare; found on the moist, gravelly bank of the Klanawa River, and in the Pachena Bay campground. (PsTh, D).

\* Deschampsia holciformis Presl

Rare; collected on an exposed rocky headland at Topaltas Bay, growing on stabilized soil in crevices in the rock. Hitchcock et al (1969) lumps this species with D. cespitosa, but there seems to be sufficient difference here on the basis of the Longer spikelets and more compact inflorescence to warrant recognition as a separate species. Hubbard makes the differentiation in his "Handbook of the Grasses of British Columbia", (1969). (FrPm).

Distichlis spicata (L.) Greene (Saltgrass)

Abundant in the lower estuarine zones, where it forms pure, dense stands at and below the tide line. (DcSv).

(Blueswildaucus Bucky. e )

Very rare; found only on the north shore of the Cordon River, growing on a moist gravel bar with numerous weed species. (PsTh).

Elymus hirsutus Presl (Wild rye)

Rare; in moist, open areas of mature hemlock forests, and along the banks of the Klanawa River. (ThBs, PsTh).

Elymus mollis Trin. in Spreng. (Beach rye, Dune grass)

An abundant and conspicuous element of the beach herb community. Grows in and behind the driftwood zone, and **into** the shrub transition

## GRAMINEAE, Cont'd

zone. Most abundant on dry, sandy south and southwest-facing beaches, where it acts as a stabilizing element, allowing the growth of various other herbs. (Em).

\* Festuca megalura Nutt. (Western six-weeks fescue)

Rare; seen only at the Pachena Bay end of the Trail, in the camp-ground and along the roadside. Growing in relatively dry, well-drained areas. Differs from F. myuros in its ciliate Lemmas. Flowering April-June. (D).

Festuca rubra L. (Red fescue)

Common on the rocky headlands, growing in small pockets of organic debris or silty soil. Also regularly found in the estuaries, in the middle zones. (FrPm, DcSv).

Festuca subulata Trin. in Bong. (Bearded fescue)

Very rare; found only on a moist seepage cliff on the coast near the Klanawa River. Growing with Adiantum pedatum. (FrPm).

' Holcus lanatus L. (Velvet grass)

Commonly occurring on disturbed areas and shell middens; and occasionally in estuaries and the beach transition zone. Usually growing on well-drained soils of Low organic content. (D, SM, DcSv, ArGs).

Hordeum brachyantherum Nevski (Meadow barley)

Fairly common in estuarine situations and salt marshes (except for Bamfield Inlet), in disturbed areas around abandoned buildings, and sporadically found on exposed rocky headlands and shell middens. (DcSv, D, SM, FrPm).

## GRAMINEAE, Cont'd.

' Lolium perenne L. (Perennial ryegrass)

Very rare; found only at the Pachena Bay campground, growing in an open, abandoned campsite on moist, well-drained soil. (D).

\* Melica subulata (Griseb.) Scribn. (Alaska oniongrass)

Very rare; discovered only on the north shore of Pachena Bay, growing behind the driftwood zone at the base of the shrub fringe in moist, shaded soil. The enlarged, bulbous base of the culm provides this plant with its common name. (ArGs).

\* Panicum pacificum Hitch. & Chase (Pacific panicum)

Scarce; growing on dry, south-facing rocky headlands between the Tsusiat River and the Nitinat Narrows, rooted in silty soils in the rock crevices. Differentiated from; occidentale Scribn. (with which it is lumped by Hitchcock et al (1969)) by strongly pubescent blades and long hairy glumes. (FrPm).

' Phleum pratense L. (Timothy)

Rare; growing on the shell middens at Whyak, and around the old lineman's cabin at Topaltas Bay. In fairly dry, well-drained soils. (D, SM).

Poa macrantha Vasey (Seashore bluegrass)

Uncommon; found on dry sandy beaches below and in the driftwood zone, and in sand blowouts on Keeha Beach and at Clo-oose. Grows with Carex macrocephala and other xerophytic herbs. (Em, D).

## GRAMINEAE, Cont'd.

! Poa pratensis L. (Kentucky bluegrass)

Commonly found in all disturbed areas, on shell middens, and around abandoned or inhabited buildings. In a wide variety of habitats and soil types, but most abundant under moist, open conditions. (D, SM).

\* Puccinellia pumila (Vasey) A.S. Hitch. (Alkali-grass)

Very common at the head of Bamfield Inlet, where it grows in dense stands with Distichlis spicata in the Low mudflat zone. P. nuttalliana (Schult.) A.S. Hitch. and P. nutkaensis (Presl) Fern. and Weatherby are very similar in appearance and habitat, and may also be present, but were not collected. (DcSv).

Trisetum cernuum Trin. (Nodding trisetum)

Rare; found behind the driftwood zone at the edge of the shrub fringe in moist, shaded soil on the north shore of Pachena Bay. Also growing in sheltered rock crevices on the rocky headlands at the same Location. (Em, FrPm).

## ARACEAE - ARUM FAMILY

Lysichitum americanum Hultén & St. John (Skunk cabbage)

Common wherever standing fresh water accumulates: in muskeg forests, pine bog forests, sphagnum bogs, and along streambanks; always in wet, mucky soil. Appears to be a staple item in the diet of black bears; on Cape Beale, most of the plants seen had been dug up by bears attempting to expose the fleshy rootstalks and underground stems. A rather strong leek-like flavour, but palatable as a seasoning when boiled. (Tp, Pc, SpLg, Np, PsTh).



## LILIACEAE - LILY FAMILY

Allium cernuum Roth in Roemer ('Nodding onion)

Sparse; fairly predictable on exposed rocky headlands and stacks, and on dry, sandy beaches, where it grows in and behind the driftwood zone. Also noted on the raised estuarine terrace on the north shore of the Gordon River. (FrPm, Em).

Erythronium revolutum Smith (Pink Easter Lily, Fawn lily)

Locally abundant in the riverine forest along the Klanawa River, but otherwise not seen. This community is well inland from the Trail, which follows the beach at this point, so the plants are in little danger of being wiped out by passing hikers. (PsTh).

Maianthemum dilatatum (Wood.) Nels. & Macbr. (False lily-of-the-valley)

A very common species, and the most prominent **trailside** wild flower. Massed along the trail allowance, especially near the Pachena Bay end of the Trail; also found in all moist but fairly open forests, in the Sitka spruce fringe, along streamsides, on the edges of the shrub fringe and shell middens, and in disturbed areas. Occurring in a wide range of habitats and soil types, but not flowering in the most extreme of these. (ThBs, TpTh, Tp, Po, PsTh, FrPm, GsLi, Em, ArGs, ThPs, D, SM, TpPc).

Streptopus amplexifolius (L.) DC. (Twisted stalk)

Very scattered, but common along the trailside for the first five miles of the Trail from Pachena Bay. Otherwise scattered in moist, shady openings in the cedar-hemlock and spruce-hemlock forests, and along streambanks. Most noticeable in August when the bright red berries have developed. (TpTh, ThPs, PsTh).

## LILIACEAE, Cont'd.

Tofieldia glutinosa (Michx.) Pers. (False asphodel)

Sparse except in most sphagnum bogs, or damp, low-lying areas where mats of sphagnum have developed; rooted directly in the sphagnum. Also occasionally found in Adiantum communities on moist seepage cliffs.

(SpLg).

\* Trillium ovatum Pursh (Western trillium, Wake-robin)

Rare; found only in a shady, mossy streambank community near the mouth of the Klanawa River, where it was fairly common. Since it blooms early in the year (March-May), when there are very few hikers, and is inconspicuous once the showy flowers have disappeared, there is very little danger that this attractive plant will be eliminated with increasing use of the Trail. (PsTh).

## IRIDACEAE - IRIS FAMILY

Sisyrinchium angustifolium Mill. (Blue-eyed grass)

Rare; found only occasionally on stabilized areas of rocky headlands, growing in soil or organic debris trapped in crevices in the rock. Most commonly seen around the shoreline of Pachena Bay, especially at Seven Mile Beach, a spectacular area rarely visited due to its inaccessibility. (FrPm).

Sisyrinchium californicum (Ker-Gawl.) Dryand. (Yellow-eyed grass)

Occurring on rocky headlands with S. angustifolium, but more widespread. Common around Pachena and Topaltas Bays, and also along certain parts of the rock shelf between Camper Bay and Owen Point. This species preserves rather poorly when dried. (FrPm).

## ORCHIDACEAE - ORCHID FAMILY

The absence of Listera caurina Piper, and L. cordata (L.) R. Br. here is surprising. Since both species are common elements of the coastal cedar-hemlock forest, it is felt that they are probably present, but were missed by chance during this study.

\* Habenaria dilatata (Pursh) Hook. (Boreal bog orchid)

Rare; found only in the pine bog forest between Logan and Walbran Creeks, and in Cullite Bog. Grows on exposed mud, rather than rooted in the sphagnum. All specimens collected were var. leuoostachys (Lindl.) Ames. Flowering June-September. (Pc, SpLg).

\* Habenaria hyperborea (L.) R. Br. in Ait. (Green-flowered bog orchid)

Very rare; found only on a moist, mossy bank of the Tsusiat River, about one-quarter of a mile inland. The densely many-flowered spike and more robust size of this orchid make it easy to distinguish from the more common H. saccata. Flowering June-August. (PsTh).

Habenaria saccata Greene (Slender bog orchid)

The most common of the orchids; found in muskeg forests, pine bog forests, sphagnum bog, and along moist, boggy parts of the Trail. Never abundant, however. (Tp, Pc, SpLg).

## DICOTYLEDONS

## SALICACEAE - WILLOW FAMILY

This survey was conducted well after the time the willow species had flowered and dispersed their fruit, so it was almost impossible to carry

## SALICACEAE, Cont'd.

out any valid identifications. Dr. C. Beil of the University of British Columbia examined the vegetative specimens, however, and was able to isolate the following two species:

Salix hookeriana Barratt in Hook. (Hooker's willow)

Scarce; found in the shrub fringe at seepage sites, at the mouths of the larger streams, and in the Logged areas behind Pachena Bay. Fairly **common** around Bamfield Inlet, as well. (ArGs, PsTh).

\* Salix scouleriana Barratt in Hook. (Scouler's willow)

Common around Bamfield Inlet, less **common** than S. hookeriana as a coastal shrub. S. sitchensis Sanson in Bong. is very similar in appearance and habitat type, and is no doubt also present, as it is one of the **most common** coastal willows on Vancouver Island. (ArGs, PsTh).

## MYRICACEAE - SWEET GALE FAMILY

Myrica gale L. (g a l e )

**Common** around the shore of Kichha Lake on muddy soil, and abundant on the stabilized sphagnum mats; also common in most other pine bog forests and sphagnum bogs. On the **trail** to the Cape Beale Lighthouse, a boardwalk passes through a pine bog forest containing dense, extensive stands of Myrica, and the fragrance is quite intoxicating. (Pc, SpIg, Np).

## BETULACEAE - BIRCH FAMILY

Alnus rubra Bong. (l d e r )

Common along river and stream banks; on the immediate coast at seepage sites ; in spruce and spruce-hemlock forests; and as a colonizer of abandoned logging roads. A good indicator species for hikers seeking fresh water. (PsTh, PsRsPm, ThPs, L).

## URTICACEAE - NETTLE FAMILY

Urtia dioica L. (Stinging nettle)

Scarce; found **only** on shell middens, and around abandoned Indian settlements; on **moist**, rich, often calcareous soils. Most abundant at Whyak, on the Nitinat Narrows, and at the head of Bamfield Inlet. (SM, D).

## LORANTHACEAE - MISTLETOE FAMILY

Arceuthobium campylopodum Engelm. (Dwarf mistletoe)

A fairly common parasite on Tsuga heterophylla; inconspicuous due to its small size, aerial growth, and orange-brown color.

## POLYGONACEAE - BUCKWHEAT FAMILY

\* Polygonum aviculare L. (Common knotweed)

Rare; found only in the lower estuarine zones of the Cheewhat River, growing just above the high tide line with Salicornia and Atriplex. This species is closely related to P. fowleri Robins., which would be the expected species in such a littoral habitat; the flower color, and lack of exertion of the achenes indicate it is P. aviculare, however. (DcSv)

## POLYGONACEAE, Cont'd.

Polygonum paronychia Cham. & Schlecht. (Black knotweed)

Sparse; found in the driftwood zone on dry, sandy beaches (Kaeha Beach, Clo-oose), and in sand blowouts. (Em).

'\* Polygonum persicaria L. (Lady's thumb)

Very rare; found only at **Whyak**, on the Nitinat Narrows, where it was growing on the shingle beach, just above the high tide line, with Rumex crispus. On the lower margin of a shell midden. (SM).

' Rumex acetosella L. (Sheep sorrel, Sour weed)

A common weed in disturbed areas and around abandoned buildings. Usually on well-drained, sandy soils, although seen in a variety of soil types. (D).

' Rumex crispus L. (Curly-leaved dock)

Scarce; found in dry, well-drained soils around abandoned buildings, and occasionally on the margins of shell middens. Most common **Whyak**. (D, SM).

' Rumex obtusifolius L. (Broad-leaved dock, Bitter dock)

Extremely rare; a single plant found growing on a shell midden at **Whyak**, in a dry, exposed area. Growing with R. crispus. (SM).

## CHENOPODIACEAE - GOOSEFOOT FAMILY

Atriplex patula (L.) S. Wats. (Lar scale)

Sparse; frequently found in the mid and lower estuarine areas, where it may be submersed at high tide, and seen occasionally on the more sheltered, moist beaches (Pachena Bay), and on shingle beaches. Highly variable in leaf size and shape. (DCSV, Em).

## CHENOPODIACEAE, Cont'd.

Chenopodium sp. L. (Goosefoot)

Very rare; found only in the lower mudflat zones of the Cheewhat estuary, with Atriplex and Salicornia. None of the specimens had inflorescences, but the general physiognomy seemed closest to that of C. album L. (DcSv).

Salicornia virginica L. (Glasswort, Saltwort)

Very abundant in the lower mudflat zones of most estuaries, where it is frequently inundated by the tide; other than this, it is only seen occasionally on protected coastal mudflats and shingle beaches. (DcSv).

## NYCTAGINACEAE - FOUR O'CLOCK FAMILY

Abronia latifolia Eschsch. (Yellow sand verbena)

Uncommon; seen only behind the driftwood zone in dry, sandy beaches (Keeha Beach, Clo-oose), and in sand blowouts and artificial clearings on the beaches. Growing in open areas of sparse vegetation. (Em, D).

## PORTULACACEAE - PURSLANE FAMILY

Montia parvifolia (Moc.) Greene

Sparse; predictable on moist seepage cliffs with Adiantum pedatum, on streamside moss-covered rocks, and very occasionally found on moist rocky headlands. Often grows vegetatively only, proliferating by stolons and shedding vegetative buds; this condition is most often seen on rocky headlands, where the central basal rosette of leaves and creeping stolons give the appearance of Sedum. (FrPm, PsTh).

## PORTULACACEAE, Cont'd.

Montia sibirica (L.) Howell (Western spring beauty)

Relatively common: found in **moist trailside** communities, especially near Pachena Bay; on moss-covered rocks along most stream banks; in shaded ravines; and in spruce-salmonberry-swordfern sites. Varies widely in size, attaining maximum growth on enriched, moist soils in ravines. (PsTh, PsRsPm).

## CARYOPHYLLACEAE - PINK FAMILY

Cerastium viscosum L. (Sticky chickweed, Mouse-ear chickweed)

Rare; found only in the Pachena Bay campground on a dry, sandy roadway. Very stunted, prostrate growth form. (D).

Honkenya peploides (L.) Ehrh. (Honkenya)

A common element of the foreshore and driftwood zone on **most** of the coastal beaches. Most **common** on **moist** sand and gravel beaches, but also seen on very dry, exposed areas. An anomalous, prostrate and straggling growth form was seen at Bamfield Inlet, the only occurrence in a **non-beach** habitat. (Em).

(Pearlwort) Isicaulis Wats.

Rare; growing occasionally on sheltered seepage cliffs with Adiantum, rooted in moss and organic debris. Most **common** on the northern shore of Pachena Bay. (FrPm).



## CARYOPHYLLACEAE, Cont'd.

† Sagina procumbens L. (Pearlwort)

Scarce; found on gravel bars on the Gordon River, and occasionally on sandy pockets in the drier rocky headlands. Usually growing with weed species such as Hypochaeris. (FrPm, D).

\* Spergularia canadensis (Pers.) G. Don (Sand spurry)

Rare; found on the mudflats at the Nitinat Narrows just above the Salicornia zone. It is common at this location, forming dense mats. (DcSv).

† Spergularia rubra (L.) J. & C. Presl (Sand spurry)

Extremely rare; found on the sandy shoreline of the south bank of the Gordon River, at the takeoff point for the trail. Much more common on the Indian Reserve. (D).

Stellaria crispa Cham. & Schlecht. (Crisped starwort)

Very scarce; found in the moist, sheltered shrub fringe at Topaltas Bay, and along the trailside near Whyak, again in a moist, sheltered area. (ArGs, D).

## NYMPHACEAE - WATER LILY FAMILY

\* Brasenia schreberi Gmel. (Water shield)

Common in open water on Kichha Lake and the small Lake near Brown's Cove; also commonly seen in the larger open bodies of water in sphagnum bogs. Usually with Nuphar. Flowering July-September, but the flowers very inconspicuous. (Np).

## NYMPHACEAE, Cont'd.

Najas polysepalum Engelm. n d L i l l y )

Common on Kichha Lake, the lake near Brown's Cove, and in open bodies of water in sphagnum bogs. Grows in shallow, warm water, rooted in the organic Lake bottom muck. (Np).

## RANUNCULACEAE - BUTTERCUP FAMILY

Aquilegia formosa Fisch. in DC. (Columbine)

Sparse; found growing on sheltered, moist rocky headlands in soil accumulated in crevices in the rocks. Most common behind the stacks on the cliffs just past the rock archway at Kerha Beach, but also occurring sporadically down the remainder of the coast. (FrPm).

Coptis asplenifolia Salisb. e a d )

Common in sphagnum bogs, pine bog forests, and other areas where sphagnum mats have accumulated. C. trifoliata (L.) Salisb. may also be present, but was not discovered. (Pc, SpIg).

Ranunculus flammula L. (Small creeping buttercup)

Sparse; found in wet mud around the margin of Kichha Lake, on the banks of Walbran Creek, and growing aquatically in the Tsusiat River. The small, bright yellow blossoms are very noticeable. (Np, PsTh).

' Ranunculus repens L. (Creeping buttercup)

Scattered; found in many moist, disturbed areas around abandoned buildings, and on the trailside near the Pachena Point and Carmanah Lighthouses. (D).

## RANUNCULACEAE, Cont'd.

Ranunculus uncinatus D. Don

Fairly common; occurs in **most** moist, disturbed areas; in the shrub fringe on protected beaches; on shell middens, and around abandoned buildings. (D, ArGs, SM).

Trautvettaria caroliniensis (Walt.) Vail (False bugbane)

Scattered through the moist riverine forest along the Klanawa River, both on the gravelly banks and in the rich, moist soil of the floodplain terrace. Also rarely found along the banks of the Tsusiat River. (PsTh).

## CRUCIFERAE (BRASSICACEAE) - MUSTARD FAMILY

' Arabis glabra (L.) Bernh. (Tower mustard)

Rare; found behind the driftwood zone in dry, sandy areas at the base of the shrub fringe. Most common on Keeha Beach. (Em).

' Brassica campestris L. (Common mustard)

Very rare; seen only on the gravel beach below the shell middens at Whyak, on the Nitinat Narrows. (SM).

'\* Brassica juncea (L.) Coss. (Indian mustard)

Extremely rare; a single plant was found growing on a stabilized slope in a spruce forest one-half mile north of the Klanawa River. This was a very difficult specimen: it lacks flowers, and the cauline leaves are entirely lyrate-pinnatifid; however it seems closest to B. juncea, and is definitely a Brassica. (PsRsPm).

## CRUCIFERAE, Cont 'd.

' Cakile edentula (Bigel.) Hook. (Sea-rocket)

Sparsely occurring in the foreshore and driftwood zones of sandy beaches, with Honkenya. Most abundant at the head of Pachena Bay, where it grows well in front of the driftwood zone on the tidal flats. (Em).

\* Cardamine breweri Wats. (Brewer's bitter cress)

Rare; found occasionally on seepage cliffs and in moist ravines under Alnus - rSpecimens collected were var. orbicularis (Greene) Detl. Flowering April-July. (FrPm, PsTh).

Cardamine occidentalis (Wars.) Howell (Bitter cress)

Rare; found only growing as an aquatic in the Tsusiat River, where it was common with Potamogeton spp. As an aquatic, it adopts a trailing growth form, rooting at the nodes. (PsTh).

'\* Sisymbrium officinale (L.) Scop. (Hedge mustard)

Very rare; seen only on the dry sand beach at Clo-oose, growing in and behind the driftwood zone with Epilobium angustifolium. Native to Europe; flowering April-August. (D).

## DROSERACEAE - SUNDEW FAMILY

Drosera anglica ~~Huds.~~ L e a v e d (sundew)

Sparse; found only in the pine bog forest on the trail to the Cape Beale lighthouse, about a half mile from the lighthouse itself. Growing fairly commonly in the sphagnum with D. rotundifolia. (Pc).

## DROSERACEAE, Cont'd.

Drosera rotundifolia L. (Hound-leaved sundew)

Abundant in all pine bog forests and sphagnum bogs, and any areas where sphagnum mats have grown. (PC, SpLg).

## CRASSULACEAE - STONECROP FAMILY

Sedum sp. L. (Stonecrop)

Rare; found on a few rocky headlands on the coast between Tsusiat Falls and Nitinat Narrows; usually in dense mats where it does occur. Only vegetative specimens were seen, so it was impossible to identify this plant to species. It is most likely S. oregonum Nutt., but S. spathulifolium Hook. is not ruled out; the leaves were reddish-tinged, a characteristic of the latter species, but this may have been due to the effects of salt spray. (FrPm).

## SAXIFRAGACEAE - SAXIFRAGE FAMILY

Boykinia elata (Nutt.) Greene

Relatively common; occurring in moist shady habitats, such as stream-banks, ravines, seepage cliffs, seepage sites in cedar-hemlock forests, and roadside ditches. Common along the Trail at the Pachena Bay end. (TpTh, PsTh, FrPm).

Heuchera micrantha Dougl. ex Lindl. (Alumroot)

Rare; found only growing in silty soil accumulated in crevices on the more sheltered side of the stacks and rocky headlands at the Cape Beale Lighthouse. Indicative of fairly extensive soil accumulation, since the long, thick taproots require a rather deep substrate. (FrPm).

## SAXIFRAGACEAE, Cont'd.

Tellima grandiflora (Pursh) Dougl. (Fringe cups)

Sparse; common along the trail allowances for the first four miles of the Trail from Pachena Bay, where it grows in sandy-organic soils in moist, shaded conditions. Also occasional along the banks of the Klanawa River, Carmanah Creek, and the Tsusiat River. (D, PsTh).

Tiarella Laciniata Hook. (False mitrewort)

Scattered; found with T. trifoliata on streambanks, on moist, sheltered sections of the trail allowances, and in open sections of the cedar-hemlock forest. (PsTh, TpTh).

Tiarella trifoliata L. (Lace flower)

Much more common than T. Laciniata, occurring in the same range of habitats plus in hemlock and spruce-hemlock forests. Another common trailside wildflower. (ThBs, TpTh, PsRsPm, ThPs, PsTh).

\* Tolmiea menziesii (Pursh) T. & G. (Youth-on-age)

Rather rare; seen only occasionally as a member of the trailside community in moist, shady areas, and by the side of the logging road leading in to Pachena Bay. The flowers are bristly in appearance due to the long, filiform petals. The common name is due to the fact that new leaves develop from the bases of the mature leaves during mid and late summer. Flowering May-July. (TpTh, D).

## GROSSULARIACEAE - CURRANT AND GOOSEBERRY FAMILY

Ribes bracteosum Dougl. ex Hook. (Stink currant)

Sparse; but a characteristic plant of moist ravines, intermittent creeks, streambanks, and shady, forested cliffs dropping from the marine terraces to the beaches. The odor of this plant is quite obvious, and its presence is often detected by smell alone. (PsTh, PsRsPm).

Ribes divaricatum Dougl. (Common gooseberry)

An infrequent element of the shrub fringe on some exposed beaches and rocky headlands. There are dense, virtually impenetrable thickets of this species on the rock outcrops forming the eastern border of Keeha Beach. Like Rosa nutkana, it is limited to the shrub fringe, and does not grow in the closed forest. (GsLi, ArGs).

\* Ribes lacustre (Pers.) Poir. (Prickly currant)

Extremely rare; only found in the shrub fringe on Keeha Beach, growing amongst R. divaricatum. There is some possibility that this specimen is only an anomalous form of R. divaricatum, as no fruit were present to confirm the identification; it is extremely bristly between the large nodal spines, however, and the leaf shape seems closest to that of R. lacustre. Flowering May-June. (ArGs).

## ROSACEAE - ROSE FAMILY

Amelanchier alnifolia Nutt. (Saskatoon berry, June berry)

Rare; found on the rocky headlands near the Port Renfrew trailhead. Grows on exposed rock in front of the shrub zone, in pockets of moss and dry soil in rock crevices. With salal, Lonicera, mosses, Selaginella. (FrPm).

## ROSACEAE, Cont 'd.

Aruncus Sylvester **Kostel.** (Goatsbeard)

Scattered; grows along roadsides in moist ditches, on seepage cliffs with Adiantum, around the shore of Kichha Lake, and along the moist trailside around Pachena Bay. Also occasionally seen in open sites in spruce-hemlock forests. (D, FrPm, PsRsPm, PsTh).

Fragaria chiloensis (L.) **Duchesne** (Beach strawberry)

**Common**; grows on stacks and rocky headlands, in and behind the drift-wood zone on sandy beaches, in sand blowouts, and rarely in estuaries. (FrPm, Em, D, DcSv).

Geum macrophyllum Willd. (Large-leaved yellow avens)

Scattered; grows on moist road and trailsides, in sheltered disturbed areas (Pachena Bay campground, around abandoned buildings), and in the shrub fringe at Pachena Bay. Looks very much like a buttercup, but is more robust than any of the Ranunculus species in the park. (D, ArGs).

Holodiscus discolor (Pursh) Maxim. (Ocean spray)

Fairly rare; seen growing in the shrub fringe at Thrasher Cove, and growing occasionally along the trailside in exposed, rocky areas between Port Renfrew and Thrasher Cove. In well-drained, rather exposed areas. (ArGs, D).

Physocarpus capitatus (Pursh) **Kuntze** (Pacific ninebark)

Rare; grows in the shrub fringe at Pachena Bay, and in the tall shrub community around the **Shantymen's** Camp at the head of the Trail. Also in the shrub fringe at Thrasher Cove. (ArGs).



ROSACEAE, Cont'd.

Potentilla pacifica Howell (Pacific silverweed)

Fairly common; found in the middle estuarine regions, on some of the moister rocky headlands, and occasionally on the margin of the shrub fringe on sheltered beaches. Quite common around Bamfield Inlet, and on the shell middens at Whyak. (FrPm, ArGs, DcSv, SM).

\* Potentilla palustris (L.) Soop. (Marsh cinquefoil)

Rare; found in stabilized sphagnum mats around the margin of Kichha Lake, and also on a rock outcropping on the southeast shore of the Lake. Decumbent, and sometimes growing aquatically. A very striking Potentilla, with deep purple blossoms. Also known as Comarum palustre L. (SpIg, Np).

Potentilla villosa Pall. ex Pursh (Woolly cinquefoil)

Common on the immediate coast on stacks and sheltered rocky headlands, growing in crevices in the rock with Plantago maritima. (FrPm).

Pyrus fusca Raf. (Pacific crab apple)

Very common; found in the tall shrub and suppressed tree layers of ravines and seepage sites in cedar-hemlock forests, in muskeg forests, along streambanks, around lake margins, on interior rock outcrops, and in windswept shrub thickets on stabilized rocky headlands. Also fairly common on shell middens and disturbed sites. In a wide variety of soil types, but exhibiting best growth on moist, organic soils.

(TpTh, Tp, GsLi, TpPc, PstH, D, SM).

## ROSACEAE, Cont'd.

Rosa nutkana Presl (Nootka rose)

Abundant in the shrub fringe, both on beaches and rocky headlands; also very common on **shell middens**, in Logged areas, and in scrubby **spruce-salal** forests; occasional in the shrub fringe of the upper estuarine zone. Usually on well-drained soils. (ArGs, GsLi, L, SM, DcSv).

\* Rubus idaeus L. (Raspberry)

Very rare; found only on the **shell midden** at Whyak, where it may have been planted for use as a domestic fruit species. This is the species from which **many horticultural** raspberries were developed, (SM)

' Rubus laciniatus Willd. (Evergreen blackberry)

Extremely rare; **only** seen along the roadside in the Port **Renfrew** Indian Reserve. It is very common on the Logging roads just outside of the park boundaries in the **same** area. (D).

Rubus leucodermis Dougl. ex T. & G. (Black raspberry)

Very rare; only found growing against the side of an abandoned building at **Brown's Cove**, on the Nitinat Narrows, and on the **shell midden** at Whyak. In both these areas, it was probably introduced as a domestic fruit species. (D, SM).

Rubus parviflorus Nutt. (Thimbleberry)

Scattered; found in moist shrub fringes on beaches and headlands, in **spruce-salal** forests, on streambanks, in Logged areas, and the shrub fringe of estuaries. Usually abundant on **shell middens**, where it may form dense stands. On moist soils. (ArGs, GsLi, PsGsPa, PsGsMd, PsTh, D, SM).

## ROSACEAE, Cont'd,

\* Rubus pedatus J.E. Smith (Strawberry dwarf bramble)

Extremely rare; found only in the sphagnum bog three-quarters of a mile northwest of the Klana River mouth, growing rooted in the sphagnum with Drosera and Vaccinium oxycoccus. None of the plants observed had flowered or produced fruit in the current year, and showed very limited stolon growth. (SpLg).

† Rubus procerus Muell. (Himalayan blackberry)

Rare; found occasionally on Cape Beale in dry, logged areas, and at Clooose, by an abandoned cabin in the old townsite. In dry, well-drained soils. An Old World species which has become widespread, and often a serious pest, in much of western North America. (D, L).

Rubus spectabilis Pursh (Salmonberry)

An abundant shrub in all forest types but muskeg, pine bogs, and the shrub fringe on rocky headlands. Forms dense, impenetrable thickets along much of the Trail, and is common in 'Logged areas, and disturbed regions. Best growth and fruit production is exhibited in moist areas, with enriched soils, but it is abundant in many dry sites as well.

Rubus ursinus Cham. & Schlecht. (Trailing blackberry)

Rare; found in a logged area on the trail from Bamfield to Topaltas Bay, in dry, gravelly, well-drained soil. This species is common outside the park in Bamfield townsite and on the Port Renfrew Indian Reserve. (L).

## ROSACEAE, Cont'd.

Sanguisorba officinalis L. (Burnet)

Common in sphagnum bogs and pine bog forests, and around the margin of Kichha Lake on exposed mud or sphagnum mats. Most conspicuous in August, when the burgundy-colored spikes have developed. (Pc, SpLg, Np).

Spiraea douglasii Hook. (Hardhack, Douglas spiraea)

Rare; fairly common around the margin of Kiohha Lake, occasional at the small lake on the trail to Brown's Cove, and seen along the boardwalk to the old **townsite** at Co-oose, where it grows with escaped **ornamentals**, and appears to have been used as a garden shrub. (NP, D).

## LEGUMINOSAE(FABACEAE) - PEA FAMILY

! Cytisus scoparius (L.) Link (Scotch broom)

Rare; present only where planted as an ornamental, or where it has escaped from garden situations. Found along the trail from the old golf course to the **old townsite** clearing at Clo-oose, where it has apparently been planted with western white pine. Also seen near the Pachena Point Lighthouse. (D).

Lathyrus japonicus Willd. (Beach pea)

A widespread and **common** species in the driftwood zone and in the fore-front of the beach shrub fringe **community**. Does not extend into the foreshore community, in front of the driftwood zone, but may grow back into the **spruce-salal** forest in dry, open areas. (ArGs, PsGsPa).

## LEGUMINOSAE, Cont'd.

\* Lathyrus palustris L. (Marsh pea)

Uncommon; found only in the middle estuary zone on the Cheewhat River, where it was fairly common in the Deschampsia cespitosa and Carex lyngbyei stands. In moist, fairly saline soil; flowering April-July. (DcSv).

† Trifolium dubium Sibth. (Hop clover)

Fairly **common** in disturbed areas, such as the Pachena Bay campground, old logging roads on Cape **Beale**, and around abandoned **homesteads**. On dry, gravelly soil in most cases. (L, D).

† Trifolium repens L. (White clover)

Rare; found in the Pachena Bay campground and in the rook herb zone by the head of the Trail at Port **Renfrew**. Also **common** in the Port Renfrew Indian Reserve, and along the sides of the logging roads. (D).

Trifolium wormskjoldii **Lehm.** (Spring-bank clover)

The **most** common of the **clovers**, and the only native species. Found on **rocky** headlands, in the beach herb zone, in the upper estuarine **com-** munities, and in disturbed areas. In sheltered, well-drained sites; never on the most exposed of the headlands or beaches. (**FrPm, Em, D, DcSv**).

Vicia gigantea Hook. (Giant vetch)

Common in the beach herb and shrub fringe communities, in the herb and shrub zones on rocky headlands, and in the scrubby **spruce-salal** forests on marine terraces. Often **common** on shell **middens**, where it is one of the **only** herbs able to grow in the dense shrub stands, by **virtue** of its climbing habit. (Em, **ArGs, FrPm, GsLi, PsGsPa, SM**).

## CALLITRICHACEAE - WATER STARWORT FAMILY

Callitriche heteroohylla Pursh ex Darby (Water starwort)

Sparse; found in the small lake off Keeha Beach, on mudflats in the riverine forest along Walbran Creek, and rooted in the Tsusiat River. Fruiting bodies are essential for accurate identification within this difficult genus; fortunately all specimens collected were in fruit, but the wide range of leaf size and shape illustrated the extreme variability of the species. (Np).

\* Callitriche stagnalis Scop. (Water starwort)

A vegetative colony of what appeared to be this species was discovered growing in the Tsusiat River, rooted in the organic muck. Although fruiting bodies are necessary for exact identification, the matted growth form and leaf shape, as well as the geographic range, appear to be most consistent with C. stagnalis. (Np).

## EMPETRACEAE - CROWBERRY FAMILY

Empetrum nigrum L. (Crowberry)

Fairly common in muskeg forests, pine bog forests, and sphagnum bogs, where it grows on the drier, raised hummocks. Very occasionally seen in the windswept scrubby thickets on the stabilized portions of exposed rocky headlands. (Tp, R, SpIg, FrPm).

## ACERACEAE - MAPLE FAMILY

Acer macrophyllum Pursh (Broad-leaved maple)

Rare in the park; found growing on the banks of the **Klanawa River**, and **very rarely** at the mouths of small streams, with Alnus. A single, large tree outside the old post office at **Co-oose** appeared to have been planted. (PsTh).

## RHAMNACEAE - BUCKTHORN FAMILY

Rhamnus purshiana DC. (Cascara)

Scattered; found on seepage sites and intermittent streams in **cedar-hemlock** and muskegforests, and around the shores of all lakes in the area. Also seen infrequently along the Logging roads leading to Pachena Bay. (TpTh, Tp, NP).

## HYPERICACEAE - ST. JOHN'S WORT FAMILY

Hypericum anagalloides C. & S. (Bog St. John's wort)

Very rare; seen only in a moist patch of sphagnum by the side of the trail leading to the Cape Beale Lighthouse. Conspicuous when in bloom due to the unusual salmon-colored flowers. (SpIg).

## VIOLACEAE - VIOLET FAMILY

This survey was carried out late enough in the spring that the violet species had already bloomed. Since many of them did not bear fruit, apparently due to their habit of growing in **extremely** shaded habitats, it was in most cases not possible to make accurate identifications. The following two species were definitely present, however.

VIOLACEAE, Cont'd.

Viola glabella Nutt. in 'I'. & G. (Yellow violet)

Very scattered; found only along streambanks, especially on **MOSS-** covered rocks or on seepage cliffs. Most common in the herb community at Clonard Creek, at the north end of the Trail. (PsTh).

Viola palustris L. (Marsh violet)

Apparently rare; found only on the banks of the Klanawa River, on moss-covered Logs and rocks.

ONAGRACEAE - EVENING PRIMROSE FAMILY

\* Epilobium alpinum L. (Alpine willowherb)

Extremely rare; growing on dry, exposed rocky Ledges at the side of the Trail, two miles out of Port Renfrew. This is an alpine species, normally found on talus slopes and mountain meadows, and not to be expected at an altitude of two hundred feet, as in this case. It does not seem likely that the plants were accidentally introduced, so it is probable that their presence is a demonstration of the phenomenon whereby alpine and subalpine species are able to invade Lower elevations due to extreme conditions, such as those which exist in coastal areas (wind, seaspray, etc.). Blooming May-July. (FrPm).

Epilobium angustifolium L. (Fireweed)

Scattered in disturbed areas, and also on shell middens. Usually very abundant in logged areas, where it dominates the herb layer and appears to be a primary invader which persists well into the later stages of succession. On well-drained mineral soils. (L, D).



## ONAGRACEAE, Cont 'd.

\* Epilobium glandulosum Lehm. (Glandular willowherb)

Uncommon; scattered along the immediate coast in the driftwood zone, where it grows on dry, exposed beaches (Topaltas Bay), and also on occasional seepage cliffs. This is another subalpine species, but it has been rather frequently recorded in coastal conditions. Blooming June-August. (Em, FrPm).

Epilobium watsonii Barbey in Brew. & Wats. (Willowherb)

Scattered; found in the same habitats as E. glandulosum, but more commonly. These two species are often difficult to separate visually in the field due to the stunted growth form of some specimens of E. watsonii on the very exposed, dry beaches. (Em, FrPm).

## UMBELLIFERAE (APIACEAE) - PARSLEY FAMILY

\* Angelica genuflexa Nutt. in T. & G. (Kneeling angelica)

Very rare; found only once growing on a moist cliff face under spruce-hemlock forest cover, one-half mile north of the Klanawa River. The specimen was vegetative only, but possessed the distinctive, abaxially geniculate rachis of the species; the leaf shape was also that of A. genuflexa. (ThPs).

Angelica lucida L. (Beach angelica, Sea watch)

Scattered; grows at the base of the shrub zone in the moist, more protected rocky headlands, occasionally in the shrub fringe of the exposed estuaries, and rarely on shell middens. On moist, well-drained regosols. (FrPm, DeSv, SM).

## UMBELLIFERAE, Cont'd.

Conioselinum pacificum (Wats.) Coult. & Rose (Hemlock parsley)

Sparse; but predictable in the driftwood zones of dry beaches; at the base of the shrub fringe where exposed sand exists; and on **rocky** headlands which are stabilized, but dry. Much more common than Angelica. On well-drained, sandy soils. (Em, ArGs, FrPm).

Glehnia leiocarpa Mathias (Beach silvertop)

Scattered; restricted to dry, sandy beaches, or sand blowouts where dune development has occurred. Found in the blowout on Keeha Beach, on the sand dunes at the **Cheewhat** River, and on the blowout where the old **Clo-oose** golf course was **built**. The prostrate, **acaulescent** growth form is very striking. (En, D).

Heracleum lanatum Michx. (Cow parsnip)

Scattered; in the forefront of the shrub fringe on mist, sheltered beaches; on sheltered stacks and rocky headlands, such as at the Cape **Beale** Lighthouse; along the banks of the larger streams and rivers; on shell middens, and in the Pachena Bay campground. (Em, FrPm, PsTh, SM, D).

Lilaeopsis occidentalis Coult. & Rose (Western Lilaeopsis)

Sparse; grows in the Lower **mudflats** of most estuaries and salt marshes, with Salicornia. Most abundant at the head of **Bamfield** Inlet. (DcSv).

Oenanthe sarmentososa Presl ex DC (Water parsley)

Rather **common** in seepage sites, around Lake margins, in slow moving streams, and in the freshwater zone of the marsh on Keeha Beach. When rooted in water, the plant has an upright growth form, but it adopts a prostrate form, rooting at the nodes, when growing on moist, silty soil. (Em, Np, PsTh, DcSv).

## UMBELLIFERAE, Cont'd.

Osmorhiza chilensis H. & A. (Sweet **cicely**)

Rare; found in a moist ravine just off Clonard Creek, and in the waterlogged ditches along the road in to Pachena Bay. Under alder and amabilis fir. (PsTh).

\* Osmorhiza purpurea (Coul. & Rose) Suksd. (Purplish sweet **cicely**)

Very rare; found only along an abandoned logging road behind Pachena Bay, which had subsequently been invaded by Alnus, and become a **streambed**. This species is normally subalpine in distribution, and rather unusual near sea level. It is difficult to distinguish from O. ohilensis, with which it frequently hybridizes (Hitchock et al, 1969). The specimens collected were definitely O. purpurea, according to the morphology of the fruit, but further collecting might well reveal hybridization; the genus is common in water-filled ditches along Logging roads just outside the park. (PsTh).

## CORNACEAE - DOGWOOD FAMILY

Cornus stolonifera Michx. (Red **osier** dog-wood)

Rare; found growing in the shrub fringe on the protected rocky headlands at the Port Renfrew trailhead, and at Thrasher Cove. In moist, organic soil accumulations. (GsLi).

Cornus unalaschkensis Ledeb. (Canada dogwood, Bunchberry)

Fairly common in cedar-hemlock forests; on the drier hummocks in muskeg and pine bog forests; as a trailside species in the drier, open areas; and in exposed, logged areas which have not yet been repopulated by hemlock, Usually does not flower in the shady cedar-hemlock forest. (TpTh, Tp, Po, D, L).

## ERICACEAE - HEATHER FAMILY

Arctostaphylos uva-ursi (L.) Spreng. (Bearberry, Kinnikinnick)

Scattered; found at the base of the shrub fringe on dry, sandy beaches (Keeha Beach, Topaltas Bay, Clo-oose), in extensive mats around the margins of sand blowouts, and in patches of soil accumulation on rocky headlands, both in the herb and shrub zones. (ArGs, FrPm, GsLi).

Gaultheria shallon Pursh. (Salal)

The most abundant shrub in the park, dominating the understory in a variety of forest types. Salal is the most familiar plant species to the person hiking the West Coast Trail, since it grows most densely in the shrub and Sitka spruce fringe on the immediate coast, and the Trail remains within this zone for a great deal of its length. Excluded only from sphagnum bogs.

Hypopitys monotropa Crantz (Pinesap)

Extremely rare; found only once in the humus and organic litter of the Sitka spruce forest on the shore of Pachena Bay. (PsRsPm).

Kalmia polifolia Wang. (Bog laurel)

A common plant in the pine bog forest and sphagnum bog. Grows primarily on raised sphagnum hummocks, although it is also seen in open areas on exposed muck; var. polifolia. (Pc, SpLg).

Ledum groenlandicum Oeder (Labrador tea)

Found in the same habitats as Kalmia, but usually slightly more common. The stands on the sphagnum mats around Kichha Lake show some of the most abundant growth, and are being harvested by local inhabitants for the production of tea. Mildly hallucinogenic. (Pc, SpLg).

ERICACEAE, Cont 'd.

Menziesia ferruginea Smith (False azalea)

A very common shrub in mature hemlock forests, cedar-hemlock stands, muskeg forest, cedar-hemlock scrub on interior rock outcrops, and Logged areas. Although common as a free-rooting species, it also frequently grows out of rotting and decayed trees and logs, sometimes at a considerable height. (ThBs, TpTh, Tp, ThPs, TpThGs, TpPc, L).

Pyrola uniflora L. (One-flowered wintergreen, Single beauty)

Scattered; a Low-density but rather constant species in very mature, open hemlock and cedar-hemlock forests. Grows in the moss layer on both decaying loge and living trees. A very attractive and delicate species. (ThBs, TpTh, ThPs).

\* Pyrola secunda L. (One-sided wintergreen)

Extremely rare; found only growing on moss-covered rocks at the base of a small waterfall in a sheltered ravine on the coast, three miles up-island from the Klanawa River. The specimen discovered did not produce blossoms. (PsTh).

Vaccinium alaskaense Howell (Alaska blueberry)

Very common; grows in cool, moist sites in hemlock, cedar-hemlock, muskeg, riverine and rocky scrub forests. On Logged, exposed areas, it is much smaller in stature. This species is very difficult to distinguish from V. ovalifolium Smith in the field if the fruit are not present and mature; it did seem, however, that V. alaskaense was often more predominant in the tall shrub layer, reaching a height of up to ten feet.

(ThBs, TpTh, Tp, Pc, ThPs, PsTh, TpPc, L).

ERICACEAE, Cont'd.

Vaccinium ovalifolium Smith (Oval-leaved blueberry)

Apparently less common than V. alaskaense, except in the pine bog forests, muskeg forests, and logged areas. More work is necessary to accurately delineate the habitat preferences and relative abundances of these two species. (ThBs, TpTh, Tp, Pc, ThPs, PsTh, TpPc, L).

Vaccinium ovatum Pursh (Evergreen huckleberry)

An abundant shrub, **especially** of the lower shrub layer, in dry, exposed, rocky, or disturbed areas of the forest. **Common** in scrubby cedar-hemlock forests on coastal headlands or interior rock outcrops, in muskeg forests, around the margins of inland bogs, on logged areas, and in disturbed parts of Cape Beale. Not found in any of the forest types on rich, deep marine terrace soils. (TpTh, Tp, TpThGs, TpPc, L, D).

Vaccinium oxycoccus L. (Bog cranberry)

Common, but inconspicuous, in pine bog forests and sphagnum bogs; grows directly on the sphagnum mats. Berries are not as frequently seen as the bright pink flowers. (Pc, SpLg).

Vaccinium parvifolium Smith in Rees (Red huckleberry)

An abundant shrub of the upper and lower shrub levels in **most** moist, shady forest types, but also very **common** in dry, exposed logged areas. Especially common in inland spruce, hemlock, and cedar forests, along streambanks, and in scrubby cedar-hemlock stands. Often grows from decaying **stumps** and logs in the logged areas. (ThBs, TpTh, Tp, PsRsPm, ThPs, TpThGs, TpPc, PsTh, L).

## ERICACEAE, Cont'd.

Vaccinium vitis-idaea L.

Apparently very scarce; found only in the pine bog between **Walbran** and Logan Creeks, and in one sphagnum bog on the margin of Kichha **Lake**. Never in flower. (Pc, SpLg).

## PRIMULACEAE - PRIMROSE FAMILY

Dodecatheon jeffreyi van Houtte (Shooting star)

Extremely rare; found only on one moist, flooded point bar on the Tsusiat River, about a quarter of a mile inland. Growing with other rare species such as Habenaria hyperborea, Veronica scutellata. (PsTh).

Trientalis arctica Fisch. ex Hook, (Starflower)

Scattered; found around the margin of Kichha Lake on exposed mud; in the pine bog between **Walbran** and Logan Creeks; and very occasionally along the trailside where sphagnum mats have formed, especially in interior rocky scrub forests. (Pc, Np, TpPc).

## PLUMBAGINACEAE - PLUMBAGO FAMILY

Armeria maritima (Mill.) Willd. (Thrift)

Rare; found only at the mouth of the Gordon River on a raised, sandy terrace, in estuarine conditions. When in seed, this plant superficially resembles wild onion. (DcSv).

## GENTIANACEAE - GENTIAN FAMILY

Gentiana douglasiana Bong. (Douglas' gentian)

Common in most pine bog forests and sphagnum bogs, **rooted** directly in the sphagnum. Especially abundant in **Cullite** Bog, and in the pine bog forest on the trail to the Cape **Beale** Lighthouse. (**Pc, SpLg**).

Gentiana sceptrum Griseb. in Hook. (Swamp gentian)

Rare; found only growing on a flooded point bar on the Tsusiat River, and in the Myrica community on the northwest shore of Kichha Lake. Appears to flower very late in the summer, and so remains inconspicuous most of the year. (**PsTh, Np**).

## MENYANTHACEAE - BUCK BEAN FAMILY

Menyanthes trifoliata L. (Buckbean)

**Very** sparse; grows in dense stands in Kichha Lake, just beyond the Scirpus zone, and occasionally in the open water areas of sphagnum bogs, with Nuphar polysepalum. (**NP, SpLg**).

Neprophyllidium crista-galli (Menzies) Gilg. (Deer cabbage)

Sparse; common in restricted areas of some sphagnum bogs and pine bog forests, especially where a layer of water has accumulated on the surface of the sphagnum. Usually near the margins of the bogs, or close to pine trees, where some shelter is provided. Forms dense, pure clumps. (**Pc, SpLg**).



## CONVOLVULACEAE - MORNING-GLODY FAMILY

Convolvulus soldanella L. (Beach morning-glory)

Very scattered; growing on exposed sandy areas of dry sand beaches, sand dunes, and sand **blowouts**. On Topaltas Beach, Keeha Beach, and the Clo-oose sand dunes. This species does not preserve well, the flowers retaining little of their clear pink **color**. (Em).

## LABIATAE (LAMIACEAE) - MINT FAMILY

\*' Glechoma hederacea L. (Ground ivy)

Bare; found **only** on a shell **midden** at **Whyak**, where it was probably planted originally, but has spread to cover large portions of the **midden**. A native of Eurasia, frequently used in America for ground cover and well-established now as a weed. Flowering April-June. (SM).

Mentha arvensis L. (Wild mint)

Found only on the shell **middens** at **Whyak**, where it is fairly widespread in sheltered areas. (SM).

Prunella vulgaris L. (Heal)

Fairly common in the herb community of rocky headlands, where it grows in the more sheltered areas in crevices in the rock; and in disturbed areas, such as the Pachena Bay campground, and portions of the Trail, where it approaches lighthouses or abandoned buildings. Usually in **moist**, well-drained soil. (FrPm, GsLi, D).

## LABIATAE, Cont'd.

\* Stachys coolyae Heller (Hedge nettle)

Sparse; occurs sporadically in the driftwood zone, usually where sub-surface moisture is present, and around the margins of shall middens.

'This species is very similar to S. mexicana Benth., being differentiated on the basis of its longer corolla tube. Since the ranges of both species overlap along the coast, it is important to examine every specimen carefully to insure accurate identification. It was found that in late summer, when the flowers are mature, the two species are relatively easy to separate; but there can be considerable difficulty in the spring and early summer, before the corolla tube has elongated to its full length. (Em, SM).

Stachys mexicana Benth. (Mexican hedge nettle)

Sparse; occurs in the same habitat types as S. coolyae, but is somewhat more common. (Em, SM).

## SCROPHULARIACEAE - FIGWORT FAMILY

Castilleja miniata Dougl. ex Hook. (Indian paintbrush)

Scattered; grows in pockets of soil on rocky headlands and stacks, in the shrub transition zone of many sandy beaches, in the stabilized shrub zones of rocky headlands, and on most shell middens. Common on the dry sea cliffs in many areas where the Trail follows the beach.

(Em, ArGs, FrPm, GsLi, SM).

## SCROPHULARIACEAE, Cont'd.

' Digitalis purpurea L. (Foxglove)

Rare; occurs along the trailside where it passes through Clooose, and on the shell middens at Whyak. In moist but well-drained, disturbed soils. (D, SM).

Mimulus guttatus DC. (Yellow monkey flower)

Very sparse; found on moist seepage cliffs and rock shelves on the immediate coast, and rarely on the sheltered, inland side of rock stacks. Common around Tsusiat Falls, and fairly regularly seen on the sea cliffs between Walbran Creek and Camper Bay; also present on the rock shelf near Owen Point. (FrPm).

Scrophularia californica Cham. & Schlecht. (Coast figwort)

Sparse; found in the shrub transition zones, immediately behind the driftwood, on moist, sheltered beaches, and on the shell middens at Whyak, along the side of the Trail, where it is common. (ArGs, SM).

Veronica americana Schwein. ex Benth. (American brooklime)

Rare; found in the shrub transition zone at the head of Pachena Bay, in moist, organically enriched soil, and on the banks of the Tsusiat River, where it grew semi-aquatically. (ArGs, PsTh).

\*' Veronica arvensis L. (Corn speedwell)

Extremely rare; found only in the Pachena Bay campground, in an old campsite clearing on dry, sandy soil. A European weed now established throughout most of North America. Flowering April-September. (D).

## SCROPHULARIACEAE, Cont'd.

\* Veronica scutellata L. (Marsh speedwell)

Extremely rare; discovered only on a flooded, grassy point bar on the Tsusiat River. A decumbent species, rooting at the nodes, and often growing semi-aquatically. In rich, moist alluvial soil. Flowering May-September. (PsTh).

## OROBANCHACEAE - BROOMRAPE FAMILY

Boschniakia hookeri Walpers (Vancouver ground cone)

Rather rare; a parasite on salal, found growing in the pine bog forest on the south shore of Kichha Lake, and in the spruce-salal forest behind Second Beach, on Cape Beale. It appears to flower early in the spring, as all specimens observed during June and July had already set seed. The somewhat larger B. strobilacea A. Gray was not discovered. (Pc, PsGsPa).

## LENTIBULARIACEAE -BLADDERWORT FAMILY

\* Utricularia vulgaris L. (Common bladderwort)

Rare; found floating in the warm, shallow water of Kichha Lake with Potamogeton spp. U. minor, found in the Broken Group Islands by Bell and Harcombe (1973), may also be present, but was not collected. This plant was never observed in bloom, at which time it is quite conspicuous due to the bright yellow, spurred flowers, which are aeri ally produced. (Np).

Pinguicula vulgaris L. (Butterwort)

Rare; found on very moist sphagnum in the bog three-quarters of a mile north of the Klanawa River, and in soil pockets on seepage cliffs

## LENTIBULARIACEAE, Cont 'd.

on the banks of the Klanawa River and Walbran Creek. Those plants growing on rock cliffs frequently do not produce flowers, but are easily recognizable by the basal rosette of slimy, glandular leaves. An insectivorous plant, like Utricularia. (SpLg, PsTh).

## PLANTAGINACEAE - PLANTAIN FAMILY

† Plantago lanceolata L. (English plantain)

Sparse; found in disturbed sites, such as the Pachena Bay campground, and along old logging roads on Cape Beale, and at the mouth of the Gordon River on a raised estuarine terrace. At this last location, the plant exhibited a dwarf stature, with a globose inflorescence, apparently in response to the saline conditions. (D, DeSv).

Plantago macrocarpa Cham. & Schlecht. (Plantain)

Very sparse; found in the inland sphagnum bog three-quarters of a mile north of the Klanawa River, and at one location on the margin of Kichha Lake. It is possible that this species is also present in some estuarine and salt marsh conditions, but was confused with P. maritima. All the specimens observed and identified, however, were much larger and less succulent than this latter species. (SpLg, Np).

† Plantago major L. (Common plantain)

Rare; found along the roadside in the Pachena Bay campground, on moist, disturbed soil. (D).

## PLANTAGINACEAE, Cont'd.

Plantago maritima L. (Marine plantain)

Common on the rocky headlands, where it grows in crevices in the rocks under **very** exposed conditions; occasional on sandy beaches under salt marsh conditions; and fairly **common** in the lower estuarine regions. The species seems to exhibit an **ecocline** gradient in stature, becoming shorter and **more** succulent, as growing conditions become more exposed and saline. (FrPm, Em, DcSv).

## RUBIACEAE - MADDER FAMILY

Galium apocynifolium (L.) A. N. S. ( )

Very scattered; found in the upper beach zone, at the base of the shrub fringe, on **moist**, sheltered beaches (northwest shore of Pachena Bay), and **rarely** on shingle beach tongues between cliffs (Keeha Beach). Has a **scrambling** growth form, and is **extremely** scabrous, **sticking** firmly to the hands and clothing when collected. (Em, FrPm).

Galium triflorum Michx. (Bedstraw)

Very scattered; found on moist sites in disturbed areas (the shrub fringe at Pachena Bay), along the **trailside** under hemlock and fir forests, along streambanks, and very **rarely** in the upper beach zone over seepage sites. G. trifidum L. may also be present, but was not encountered. (D, PsTh, Em).

## CAPRIFOLIACEAE - HONEYSUCKLE FAMILY

Linnaea borealis L. (Twinflower)

This attractive, mat-forming plant is common in most forest areas as a ground level herb. It is abundant in muskeg, pine bog and cedar-hemlock forests, in sphagnum bogs on the drier hummocks, in spruce-salal forests on rock outcrops, and in logged areas, where it grows on decaying stumps. Habitat ranges from dry to moist, on a variety of soil types. (TpTh, Tp, Pc, SpIg, PsGsMd, L).

Lonicera involucrata (Rich.) Banks ex Spreng. (Black twinberry)

An abundant shrub in the windbeaten thickets on the outer coast. Also common in the spruce-salal forest behind this fringe; in spruce-salmonberry forest types; along open streambanks near the ocean; on shell middens, and in the shrub transition zone behind estuaries. One of the few shrubs producing inedible berries. (ArGs, PsGsPa, GsLi, PsGsMd, PsRsPm, PsTh, SM, DcSv).

Sambucus racemosa L. (Red elderberry)

Scattered; found commonly in spruce-salmonberry-swordfern forests on marine terraces, rarely in the shrub fringe on moist beaches, and occasionally in logged areas. This tree is very common along the Trail at Clo-oose, filling an entire ravine under the boardwalk which leads from the beach to the northern end of the old townsite. It may have been planted as an ornamental species at one time, but has spread rapidly and extensively to cover much of the area. (PsRsPm, ArGs, L, D).

## CAPRIFOLIACEAE, Cont'd.

Symphoricarpos albus (L.) Blake (Snowberry)

Rather rare; found in the shrub fringe and spruce-salal forest at Second Beach, on the north side of Cape Beale, and in the logged area near Brown's Cove, on the Nitinat Narrows. Also present in the Pachena Bay campground. On moist, sheltered sites with well-drained soil.

(ArGs, PsGsPa, L).

Viburnum edule (Michx.) Raf. (Squashberry)

Rare; found only along the banks of the Tsusiat River, with Lonicera and Alnus, growing about one-quarter mile inland from the coast. (PsTh).

## VALERIANACEAE - VALERIAN FAMILY

Valeriana sitchensis Bong. (Mountain valerian)

Very rare; found on the banks of the Klanawa River, growing on shaded, mossy rocks with Viola glabella and Trautvettaria. This is normally a subalpine species, and not usually found at sea level, as in this case. In its normal habitat, Valeriana has an upright growth form, but all of the Klanawa River plants were decumbent or prostrate. (PsTh).

## CAMPANULACEAE - HAREBELL FAMILY

Lobelia dortmanna L. (Water lobelia)

Found only growing on the streambed of the Tsusiat River with other aquatic plants, and very rare at this location. (PsTh).



## COMPOSITAE (ASTERACEAE) - SUNFLOWER FAMILY

Rhillea millefolium L., (Yarrow)

Common; grows on dry rocky headlands in debris-filled crevice;; behind the driftwood zone on sandy beaches; on the seaward side of the shrub fringe on south-facing headlands and beaches; on shell middens; in disturbed areas, and around the margins of salt marshes.

(FrPm, GsLi, Em, D, SM, DcSv).

Ambrosia chamissonis (Less.) Greene (Silver beachweed)

Rare; found in the driftwood zones of Pachena Beach and Keeha Beach; on dry, exposed sand. Hitchcock et al (1969), lists this species as Franseria chamissonis Less. (Em).

Anaphalis margaritacea (L.) B. & H. (Pearly everlasting)

Common on dry rocky headlands; behind the driftwood zone on dry beaches with a sandy transition area; on sheltered but dry sea cliffs, and in logged areas. Often does not flower, but is very conspicuous when in bloom and for many weeks afterward, due to the numerous, scarious white bracts of the inflorescence. (FrPm, Em, GsLi, L, D, DcSv).

Apargidium boreale (Bong.) T. & G. (Bog dandelion)

Restricted to pine bog forests and sphagnum bogs, where it is fairly common. May occur occasionally in muskeg forests where sphagnum is abundant. (Pc, SpLg).

\*! Arctium minus (Hill) Bernh. (Burdock)

Extremely rare; found only on the most seaward midden at Whyak, growing on the trail between the old buildings. A Eurasian weed, established widely throughout North America in waste places. Flowering July-October. (SM).

## COMPOSITAE, Cont 'd .

\* Arnica amplexicaulis Nutt. (Clasping arnica)

Rare; found on the banks of the Klanawa River, in well-drained gravel, on moist cliffs near the 'Tauaiat Falls, and along the rock shelf between Walbran Creek and Camper Bay. The specimens collected are somewhat anomalous in that they are more branched and bushy in form than is normal for the species. (PsTh, FrPm).

Artemesia suksdcrfii Piper (Mugwort, Beach sagebrush)

Sparse; found on the gravel bank at the mouth of Camper Creek, and occasionally along the dry cliff faces between the Klanawa River and Michigan Creek. All the plants examined had ciliate involucre bracts, a characteristic of the closely-related A. douglasiana Bass., but were definitely A. suksdcrfii according to involucre shape and flower number. (PsTh, Em).

Aster subspicatus Nees (Aster)

Fairly common; found in the upper beach area, behind the driftwood zone, on a number of dry beaches; in the beach herb community over seepage sites; at Camper Bay, and on stabilized rocky headlands south of Camper Bay. (Em, FrPm).

† Bellis perennis L . (English daisy)

Very rare; found only in the Pachena Bay campground on an old campsite in dry, sandy soil. (D).

† Chrysanthemum leucanthemum L. (Ox-eye daisy)

Rare; found only in the Pachena Bay campground, in old clearings and along the sides of some of the logging roads. A widespread weed in some of the logged areas just outside the park. (D).

## COMPOSITAE, Cont 'd.

\* Cirsium edule Nutt. (Indian thistle)

Extremely rare; found only on a dry, slumped clay cliff near the Darling River. Hitchcock et al (1969) state that this is a very distinct species, readily separable from C. brevistylum Cronq.; the specimens collected in this study, however, were very difficult. They exhibited the exserted style characteristic of C. edule, but the corolla proportions of tube and neck were more like those of C. brevistylum. As these are the two supposedly constant and distinctive features separating the species, it is possible that a hybrid may have been encountered : the vegetative characteristics were closer to C. edule, and were relied upon for final identification. (ArGs).

† Cirsium vulgare (L.) Ait. (Shaw's thistle)

Also very rare; found on a gravel bar on the north shore of the Gordon River, in a disturbed area that may have once been part of an old Logging road. In well-drained, gravelly soil. (II).

\*1 Crepis capillaris (L.) Wallr. (Smooth hawkbeard)

Very rare; found on a gravel bar on the north shore of the Gordon River, in a disturbed area, with numerous other weed species. A yellow-flowered hawkbeard native to Europe, and introduced from southern British Columbia to California, west of the Cascades. Flowering May-October. (D).

Hieracium albiflorum Hook. (White hawkweed)

Rare; found only in the sand blowout on Keeha Beach, on dry, sandy, well-drained soil. The only white-flowered hawkweed. (Em).

COMPOSITAE, Cont'd.

' Hypochaeris radicata L. (Cat's ear)

A common weed in dry, well-drained areas. Found often on sheltered rocky headlands in the herb zone and at the base of the shrub fringe; on Topaltas and Keeha Beaches, and in many disturbed areas around abandoned buildings. (FrPm, GsLi, Em, D).

' Lactuca muralis (L.) Fresen. (Wild lettuce)

Very sparse: found on the banks of Walbran Creek, on gravel; around the buildings and dock at Brown's Cove, on sandy gravel; and on the shell middens at Whyak. (D, SM, PsTh).

\* Petasites frigidus (L.) Fries (Coltsfoot)

Very scattered; seen in moist ravines on the cliffs under spruce-hemlock forest a mile upisland from the Klanawa River, and on the banks of Logan Creek, in moist gravel. This plant is unusual in that it flowers in the early spring (March-June), before the leaves have developed, so that leaves and flowers are not observed at the same time. The large, palm-shaped leaves are readily recognizable without the inflorescence, however. (PsTh).

\* Prenanthes alata (Hook.) D. Dietr. (Rattlesnake root)

Rare; found on the banks of the Klanawa River, on moss-covered rocks, and on the gravel Landing at Mud Cove, on Cape Beale. In moist, gravelly situations, usually in the shade. Flowering July-September. (PsTh).

## COMPOSITAE, Cont'd.

' Senecio sylvaticus L. (Groundsel, Butterweed)

Extremely rare; found on the north bank of the Gordon River in a gravelly area which may once have been a logging road. Growing with numerous other weed species, in dry, well-drained soil. (D).

Solidago canadensis L. (Goldenrod)

Rare; found on the dry, slumped clay cliffs near the Darling River, in a seepage site in the beach herb community with Elymus at Squeaking Beach, and on a gravel bar on the north shore of the Gordon River. The specimen at Gordon River was the only one which was observed to have bloomed, On well-drained soils. (Em, D).

' Sonchus asper (L.) Hill (Sow thistle)

Very rare; seen only on Keeha Beach in the sandy transition zone behind the driftwood area. Very dry, exposed conditions. (Em).

Tanacetum douglasii DC. (Tansy)

Sparse; found behind and in the driftwood zone on Keeha Beach, on a rocky headland on Whittlestone Point (Cape Beale), and in the disturbed areas around the old graveyard and golf course at Whyak. On dry, sandy soil, except on Whittlestone Point, where it was growing in fairly moist soil accumulated in crevices in the rocks. (Em, FrPm, D).

\*1 Tanacetum vulgare L. (S y )

Extremely rare; a single plant was discovered on a disturbed gravel bar on the north shore of the Gordon River. Growing on well-drained gravelly soil with numerous other weed species. A native of Europe which is now widespread in North America. Flowering July-October. (D).

COMPOSITAE, Cont'd.

' Taraxacum officinale Weber (Dandelion)

Very rare; seen only on the Trailside at Clo-oose, growing with Hypochaeris radicata and Poa pratensis, and on the shell middens at Whyak. It seems probable that this species will spread, in view of its prolific seed production and weedy habit. (D, SM).

## ORNAMENTALS

Several ornamental plants were found growing as garden escapes, or around abandoned buildings. They are not naturalized species, and will no doubt eventually be eliminated by native plants. The following is a list of these exotics, in many cases identified only to genus because of the difficulties involved in sorting out the numerous horticultural varieties which have been artificially produced by man. Current Ly inhabited areas were not considered in collecting these specimens.

- \* Arrhenatherum elatius (L.) Presl Striped oatgrass. (GRAMINEAE) Found beside the boardwalk leading from the old resort. townsite at Clo-oose toward Brown's Cove. Escaped from the garden of the game warden.
- \* Hedera helix L. Ivy. (ARALIACEAE) Found in an old garden at the side of the Trail as it led through Clo-oose.
- \* Hemerocallis s p . L . Day lily. (LILIACEAE) Found in the same garden site as Hedera, at Clo-oose.
- \* Hesperis s p . L . Rocket. (CRUCIFERAE) On a shell midden at Whyak, in an old garden plot.
- \* Hydrangea macrophylla Ser. Hydrangea. (SAXIFRAGACEAE) Beside the boardwalk near the game warden's cabin at Clo-oose, with Arrhenatherum, also escaped from his garden.
- Ilex aquifolium L. English holly. (AQUIFOLIACEAE) On a shell midden at Whyak, behind an abandoned building.
- \* Papaver s p . L . Poppy. (PAPAVERACEAE) In an old garden at the side of the Trail as it Led through Clo-oose.

## BIBLIOGRAPHY

- Abram, L. and R.S. Ferris. 1940-60. Illustrated flora of the Pacific states. Stanford University Press, Stanford. 4 vols.
- Bailey, L.H. 1951. Manual of cultivated plants. MacMillan Co., New York. 1116 pp.
- Baker, T. 1971. Soils of the Tofino-Ucluelet lowland. unpublished. Department of Soil Sciences, University of British Columbia, Vancouver. 6 pp.
- Baker, T. 1972. Preliminary soil map of the Tofino-Ucluelet lowland. unpublished. Department of Soil Sciences, University of British Columbia, Vancouver.
- Bell, M.A.M. 1971. Annotated bibliography of the National Park, Ucluelet, British Columbia: including references on adjacent coastal areas of Vancouver Island. unpublished. Victoria. 185 pp.
- Bell, M.A.M. 1972. Flora and vegetation of Pacific Rim National Park: Phase I, Long Beach. National and Historic Parks Branch, Department of Indian Affairs and Northern Development, Government of Canada. 196 pp.
- Bell, M.A.M. and A.P. Harcombe. 1973. Flora and vegetation of Pacific Rim National Park: Phase II, Broken Group Islands. National and Historic Park Branch, Department of Indian Affairs and Northern Development, Government of Canada. 174 pp.
- Bhoojedhur, S. 1968. Genesis of a podzol sequence on the west coast of Vancouver Island. M.Sc. thesis, Department of Soil Science, University of British Columbia. 92 pp.
- Bremner, J.M. 1970. The geology of Wreck Bay, Vancouver Island. unpublished M.Sc. thesis. Department of Geology, University of British Columbia. 242 pp.



- British Columbia Department of Lands and Forests, Forest Service. 1951  
Ecological studies, west coast of Vancouver Island. pp. 39-44.
- Byrne, T. 1973. The West Coast Trail - a reconnaissance. Canadian  
Wildlife Service, Edmonton (National Parks Contract No.  
WRO 72/73 #104). 158 pp.
- Calder, J.A. and R.L. Taylor. 1965. Flora of the Queen Charlotte  
Islands. Canadian Journal of Botany. 43:1396-1397.
- Calder, J.A. and R.L. Taylor. 1968. Flora of the Queen Charlotte  
Islands, Part I. Research Branch, Canada Department of Agriculture,  
Monograph no. 4. 659 pp.
- Canada Department of Transport, Meteorological Branch. 1967. Temperature  
and precipitation tables for British Columbia. 46 pp.
- Canada Department of Transport, Meteorological Branch. 1968. Climatic  
Normals, Volume 5: Wind. 95 pp.
- Cooper, W.S. 1958. Coastal sand dunes of Oregon and Washington. Geol.  
Soc. Amer. Memoir 72.
- Cordes, L.D. 1972. An ecological study of the Sitka spruce forest on  
the west coast of Vancouver Island. Ph.D thesis, University of  
British Columbia. 452 pp.
- Cordes, L.D. and V.J. Krajina. 1968. Mecodium wrightii on Vancouver  
Island. American Fern Journal 58(4): 181.
- Cordes, L.D. and G.A. MacKenzie. 1972. A vegetation classification for  
Phase I of Pacific Rim National Park. pp. 37-59. In: J.G. Nelson  
and L.D. Cordes (eds.). Pacific Rim; an ecological approach to a  
new Canadian national park. Studies in land use history and landscape  
change, National Park Series No. 4. University of Calgary.

- Daubenmire, R.F. 1969. Ecologic plant geography of the Pacific Northwest. *Madroño* 20(3): pp. 111-128
- Day, W.R. 1957. Sitka spruce in British Columbia. Forestry Commission Bull. No. 28
- Dolmage, V. 1920. West coast of Vancouver Island between Barkley and Quatsino Sounds. Canada Dept. Mines, Geol. Sur. Summ. Hpt., Victoria, pp. 12A-22A
- Fink, B. 1935. The Lichen flora of the United States. University of Michigan Press, Ann Arbor. 426 pp.
- Fonda, R.W. and L.C. Bliss. 1969. Forest vegetation of the montane and subalpine zones, Olympic Mountains, Washington. *Ecol. Mono.* 39: pp. 271-301.
- Franklin, J.F. and C.T. Dyrness. 1969. Vegetation of Oregon and Washington. U.S.D.A. For. Serv. Research Paper PNW-80. 216 pp.
- Frankton, C. and G.A. Mulligan. 1970. Weeds of Canada. Canada Department of Agriculture, Ottawa. 217 pp.
- Halstead, E.G. 1968. The Cowichan ice tongue, Vancouver Island. *Can. J. Earth Sci.* 5: pp. 1409-1415.
- Hanneson, B. 1962. Changes in the vegetation on coastal dunes in Oregon. M.Sc. thesis, Univ. Oreg., Eugene. 103 pp.
- Hansen, H.P. 1947. Postglacial forest succession, climate, and chronology in the Pacific Northwest. *Transactions Am. Phil. Society, New Series.* Vol. 37, Part I.
- Harris, A.S. and Robert H. Ruth. 1970. Sitka spruce - a bibliography with abstracts. U.S.D.A. Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. PNW-105.
- Heusser, C.J. 1960. Late-Pleistocene environments of North Pacific North America. *Am. Geographical Soc., Spec. Publ. No. 35.*

- Hitchcock, C.L., A. Cronquist, M. Ownbey and J.W. Thompson. 1955, 1959, 1961, 1964, 1969. Vascular plants of the Pacific Northwest. Part 1 (1969), Vascular Cryptogams, Gymnosperms and Monocotyledons; Part 2 (1964), Salicaceae to Saxifragaceae; Part 3 (1961), Saxifragaceae to Ericaceae; Part 4 (1959), Ericaceae through Campanulaceae; Part 5 (1955), Compositae. Univ. Washington Press, Seattle, Wash.
- Hubbard, W.A. 1955. The grasses of British Columbia. British Columbia Provincial Museum Handbook no. 9, Victoria. 205 pp.
- Hultén, E. 1968. Flora of Alaska and neighboring territories. Stanford University Press, Stanford. 1008 pp.
- Jepson, W. 1957. A manual of the flowering plants of California. University of California Press, Berkeley. 1238 pp.
- Jones, C.N. 1936. A botanical survey of the Olympic Peninsula, Washington. Univ. Wash. Publ. Biol. Vol. 5.
- Krajina, V.J.** 1960. Can we find a common platform for the different schools of forest type classifications? *Silva Fenn.* 105: 50-55.
- Krajina, V.J. 1965. Biogeoclimatic zones and classification of British Columbia. *Ecol. Western N.A.* 1: 1-17.
- Krajina, V.J. 1969. Ecology of forest trees in British Columbia. *Ecol. of Western N.A.* 2: 1-146.
- Kumler, M.L. 1969. Plant succession on the sand dunes of the Oregon coast. *Ecol.* 50: 695-704.
- Kuramoto, R.T. 1965. Plant associations and succession in the vegetation of the sand dunes of Long Beach, Vancouver Island. M.Sc. thesis, Univ. British Columbia. 87 pp.
- Lanjouw, J. (ed.). 1956. International code of botanical nomenclature. International Association of Plant Taxonomy, Utrecht. 338 pp.

- Lawton, E. 1971. Moss flora of the Pacific Northwest. The Hattori Botanical Laboratory, Japan. 362 pp.
- Lesko, G.L. 1961. Ecological study of soils in the Coastal Western Hemlock Zone. M.Sc. thesis, Univ. British Columbia.
- Lyons, C.P. 1952. Trees, shrubs and flowers to know in British Columbia. J.M. Dent, Toronto. 168 pp.
- Mackenzie, K. 1940. North **American** Cariceae. New York Botanical Garden, New York. 2 vols.
- Mullineaux, D.R., H.H. Waldron and M. Rubin. 1965. Stratigraphy and chronology of Late interglacial and early Vashon glacial time in the Seattle area, Washington. U.S. Geol. Surv. Bull. pp. 1194-1200.
- Munz, A. 1964. Shore wildflowers of California, Oregon and Washington. University of California Press, Berkeley and Los Angeles. 122 pp.
- Nasmith, H. 1970. Pleistocene geology of the Queen Charlotte Islands and southern British Columbia. In: Smith, R.A. and J.W. Smith (eds.). **Proceedings** of the 2nd annual paleo-environmental workshop of the U. of Calgary Archaeological Assoc.
- National Soil Survey Committee of Canada. 1970. The system of soil classification for Canada. Queen's Printer, Ottawa. 249 pp.
- Nelson, J.G. and L.D. **Cordes**. 1972. A reconnaissance study of the glacial geomorphology of the Ucluelet-Tofino area. pp. 26-36. In: J.G. Nelson and L.D. Cordes (eds.). Pacific Rim; an ecological approach to a new Canadian national park. Studies in Land Use History and Landscape Change, National Park Series No. 4. University of Calgary.
- Oosting, H.J. 1954. Ecological processes and vegetation of the maritime strand in the southeastern United States. Bot. Rev. 20: 226-261.

- Orloci, I., 1961. Forest types of the Coastal Hemlock Zone. M.Sc. thesis, Univ. British Columbia.
- Peck, M.E. A manual of the higher plants of Oregon. Blinford's and Mort, 866 pp.
- Sawbridge, D.F. and M.A.M. Bell. 1972. Vegetation and soils of shell middens on the coast of British Columbia. Ecology 53(5): 840-849.
- Schofield, W.B. 1969a. A checklist of Hepaticae and Anthocerotae of British Columbia. Syesis 1(1968): 157-162.
- Schofield, W.B. 1969b. A selectively annotated checklist of British Columbia mosses. Syesis 1(1968): 163-175
- Soper, J.H., T.C. Brayshaw, and M.J. Shechpanek. 1969. Checklist of vascular plants of Pacific Rim National Park, Vancouver Island. B.C., unpublished. National Museum, Ottawa.
- Szczawinski, A.F. 1959. The orchids of British Columbia. British Columbia Provincial Museum Handbook 16, Victoria. 124 pp.
- Szczawinski, A.F., 1962. The heather family of British Columbia. British Columbia Provincial Museum Handbook 19, Victoria. 205 pp.
- Steward, A.N., L.R. Dennis, and H.M. Gilkey. 1960. Aquatic plants of the Pacific Northwest. Oregon State College, Corvallis, Oregon. 184 pp.
- Taylor, T.M.C. 1966. The lily family (Liliaceae) of British Columbia. British Columbia Provincial Museum Handbook 25, Victoria. 109 pp.
- Taylor, T.M.C. 1966. Vascular flora of British Columbia, preliminary checklist. Department of Botany, University of British Columbia, Vancouver. 31 pp.
- Taylor, T.M.C. 1970. Pacific Northwest ferns and their allies. University of Toronto Press, Toronto. 247 pp.

- Valentine, K.W.C. 1969. The soils of the Tofino-Ucluelet lowland on the west coast of Vancouver Island, British Columbia. unpublished. Canadian Department of Agriculture, Research Branch, Vancouver, B.C. 64 pp.
- Wade, L.K. 1965. Vegetation and history of the sphagnum bogs of the Tofino area, Vancouver Island. M.Sc. thesis, Dept. of Botany, University of British Columbia. 125 pp.
- Wiedemann, A.F. 1966. Contributions to the plant ecology of the Oregon coastal sand dunes. Ph.D. thesis, Ore. State Univ., Corvallis. 255 pp.

## APPENDIX I

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT  
NATIONAL & HISTORIC PARKS BRANCH

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TERMS OF REFERENCEFOR

Contract WR 15-73  
April 10, 1973

A Vegetative Community Mapping and  
Vascular Plant Inventory - Phase III  
Pacific Rim National Park

Dr. L. D. Cordes of the University of Calgary, Calgary, Alberta, hereinafter referred to as the Consultant agrees to supply all labour, plant, material and equipment, professional and technical advice and assistance necessary to perform the work to provide a Vegetative Community Mapping and Vascular Plant Inventory - Phase III, Pacific Rim National Park, in accordance with the Terms of Reference dated April 10, 1973 and the Consultant's letter dated April 3, 1973, both attached to and forming a part of this contract to meet the requirements of the Department of Indian Affairs and Northern Development, National and Historic Parks Branch.

Purpose

The project covers the provision of information on the vegetative communities and vascular plants of the Westcoast Trail Section (Phase III) of Pacific Rim National Park.

Project Requirements

More specifically but without limiting the generality of the foregoing, the project requirements shall include:

The Contractor shall:

1. Map the vegetative communities **of** the Westcoast **Trail** (Phase **III**) in the format used in "Flora and Vegetation of Pacific Rim National Park, Phase I, Long Beach" 1971 by Dr. M.A.M. Bell and "Flora and Vegetation of Pacific Rim National Park, Phase II, Broken Island Group" 1972 by Dr. M.A.M. Bell and Mr. A. Harcombe. The plant community boundaries shall be plotted on one 10 mil acetate overlay at a scale of 1:25,000. The overlay shall be adequately labelled, titled and indexed. Communities are to be delineated by shading rather than colour. The use of "pres-type" or "letra-set" shading is preferred. In addition, each report text shall contain one coloured vegetative map on paper, similar to that provided in the aforementioned reports on Phases I and II of Pacific Rim National Park. The National and Historic Parks Branch shall provide the contractor with an adequate base map on which overlays can be prepared. The unmarked base map will be returned to this Branch upon completion of the project.
2. Prepare a report text (in six copies), in the format of the aforementioned reports on Phase I and II of Pacific Rim National Park, that will include the following at Least:
  - a) A vegetative description of each plant community mapped in (1) above. The description should include the soil types and topographic features commonly associated with the community and a calculation of the percentage of the entire area covered by that community.
  - b) An annotated checklist of the higher plants (fern, gymnosperms, angiosperms) found in the area. These notations shall include



species abundance, distribution and comments on the site in which the plant is generally found.

c) Colour photographs of the various vegetative communities delineated in (L) and (4) (a) above.

3. Field surveys and vegetative descriptions and preliminary mapping will be carried out with the aid of aerial photographs and extensive ground checks on a representative sample of the Westcoast Trail (Phase III) sections of Pacific Rim National Park.
4. Aerial photographs will be provided by the National and Historic Parks Branch.
5. ALL materials required for the field, laboratory, report text and mapping requirements of this project (except where otherwise noted) will be provided by the contractor.
6. The National and Historic Parks Branch will provide free delivery (to beach areas), on a weekly basis, of field requirements, i.e. food, gas, etc.. Materials delivered under this arrangement will have been previously purchased and identified in Victoria by the contractor.
7. ALL colour photo negatives, original maps, and the manuscript copy of the final report will be provided to this Branch upon completion of the project .

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