THE VEGETATION OF ALPHA AND GRIFFIN ISLANDS

VICTORIA, B.C.

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Islands... "are a simpler microcosm of the seemingly infinite complexity of continental and oceanic biogeography. By their very multiplicity, variation in shape, size, degree of isolation and ecology, islands provide the necessary replications in natural "experiments"..."

McArthur, R.H. 1967

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ABSTRACT

During the Fall of 1977 the vegetation of Alpha and Griffin Islands, Victoria, B.C. was described and classified. The Braun-Blanquet releve method of phytosociation was used in conjunction with the Ceska-Roemer computer program. Using six species groups, five communities, i.e. Inland *Salix*, *Camassia* meadow, *Festuca rubra* rock crevice, *Elymus* beach and *Atriplex* shingle community type, were determined. Nine community subtypes were further classified. Plant communities were shown to reflect environmental factors. Soil conditions, moisture regime distance from shore and biotic factors were considered to have a major effect on vegetation distribution and successional patterns. Consideration of land capability indicated that both Alpha and Griffin Inlands have a high potential for Ecological reserve status.

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INTRODUCTION

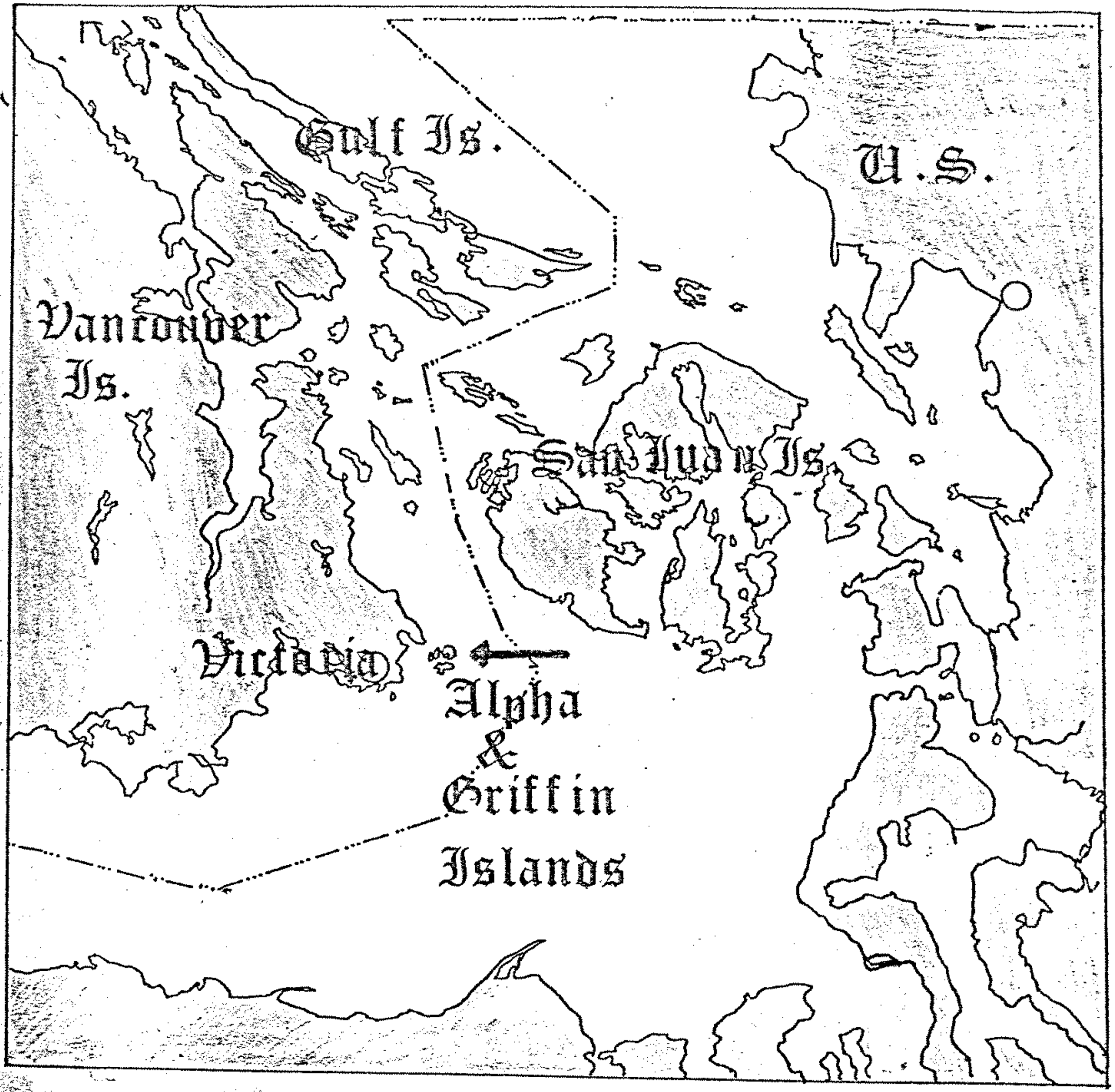
Plant ecology describes the vegetation of an area in terms of distinct species group associations termed communities. Plant communities are recognized by their uniformity and homogenity. They exist as a function of the total physical environment. (Mueller-Dombois and Ellenberg, 1977).

In the fall of 1977, as part of a Biology 418 group project the plant communities of Alpha and Griffin Islands, Victoria, B.C. were classified and described. Selected environmental and cultural features were correlated with vegetation community patterns.

The purpose of the study was to familiarize ourselves with the Braun-Blanquet method of phytosociological classification. Information collected by this method was then used to map the vegetation communities on Alpha and Griffin Islands.

Once the communities were described it was possible to assess their successional relationships. Other objectives of the report include a study of the relative productivity of each community, an estimation of the effect of grazing ~~and island size~~ upon vegetation patterns, a correlation of animal activity in the communities described and an assessment of the management options.

The study area was chosen due to floristic diversity. The islands provide a wide variety of maritime plant community types from which data can be obtained to compare environmental features with existing vegetation. Few studies have been done on the diminishing, local maritime communities, which emphasizes the necessity of this report. By classifying and comparing the plant communities of Alpha and Griffin Islands we hope to further the understanding of native vegetation within the Victoria area.



MAP 1 [redacted] LOCATION MAP – ALPHA AND GRIFFIN ISLANDS

SCALE 1:600,000

THE STUDY AREA

Alpha and Griffin Islands are located in the Chatham-Discovery Island group approximately 2 miles south of Victoria, B.C. (Latitude 48° 26' N. and Longitude 123° 13'-14' W.) Griffin Island, containing lots 154, 155 and 156, has an area of 7.60 acres and Alpha, containing lots 151 and 152, has an area of 1.79 acres. (see Map 1).

The islands are located within the Coastal Douglas Fir (Dry) Biogeoclimatic Zone under the classification scheme proposed by Krajina in 1965. Both Alpha and Griffin are characterized by showy vernal meadows and a diversity of marine associated flora, ~~and~~ a diminishing habitat in British Columbia.

Climate

The climate of the study area is Mediterranean (R. Chilton, 1973). This climate is moderated by the Japanese current and is characterized by warm, dry summers and moist, cool winters. The average mean monthly temperature for 1976 taken from Gonzales Hill is 12.8°C. The annual precipitation for 1976 was 554.1 cm. Wind is almost a constant factor of the island environment. Winter monthly mean speeds of 15 MPH are common while summer wind speeds usually average between 10-15 MPH. In summer, the prevailing wind is from the South-West and in Winter cool, wet winds and storms come from the South, East and North.

An Energy-Budget compiled from Climatic Data shows a soil moisture deficiency between the months of May to October. (see Appendix 3 for Method, Energy Budget, Charts and Graphs).

Topography

Alpha and Griffin are low lying islands with gentle topography. The greatest elevation of approximately 4 Metres above mean sea level occurs on Griffin Island. Both islands are characterized by numerous small,

Topography (cont'd)

weathered outcrops. The coastline of the islands is characterized by an accreating shingle beach in protected bays or dissected outcrops of grano-diorite in more exposed areas. The tidal range was ~~between~~ 3 m .

. The aspect of both islands was open although micro-topographical differences accounted for different degrees of exposure on certain sites.

Geological History

The geological history of Alpha and Griffin is described according to volcanic bedrock formation, pre-glacial, glacial and post-glacial processes.

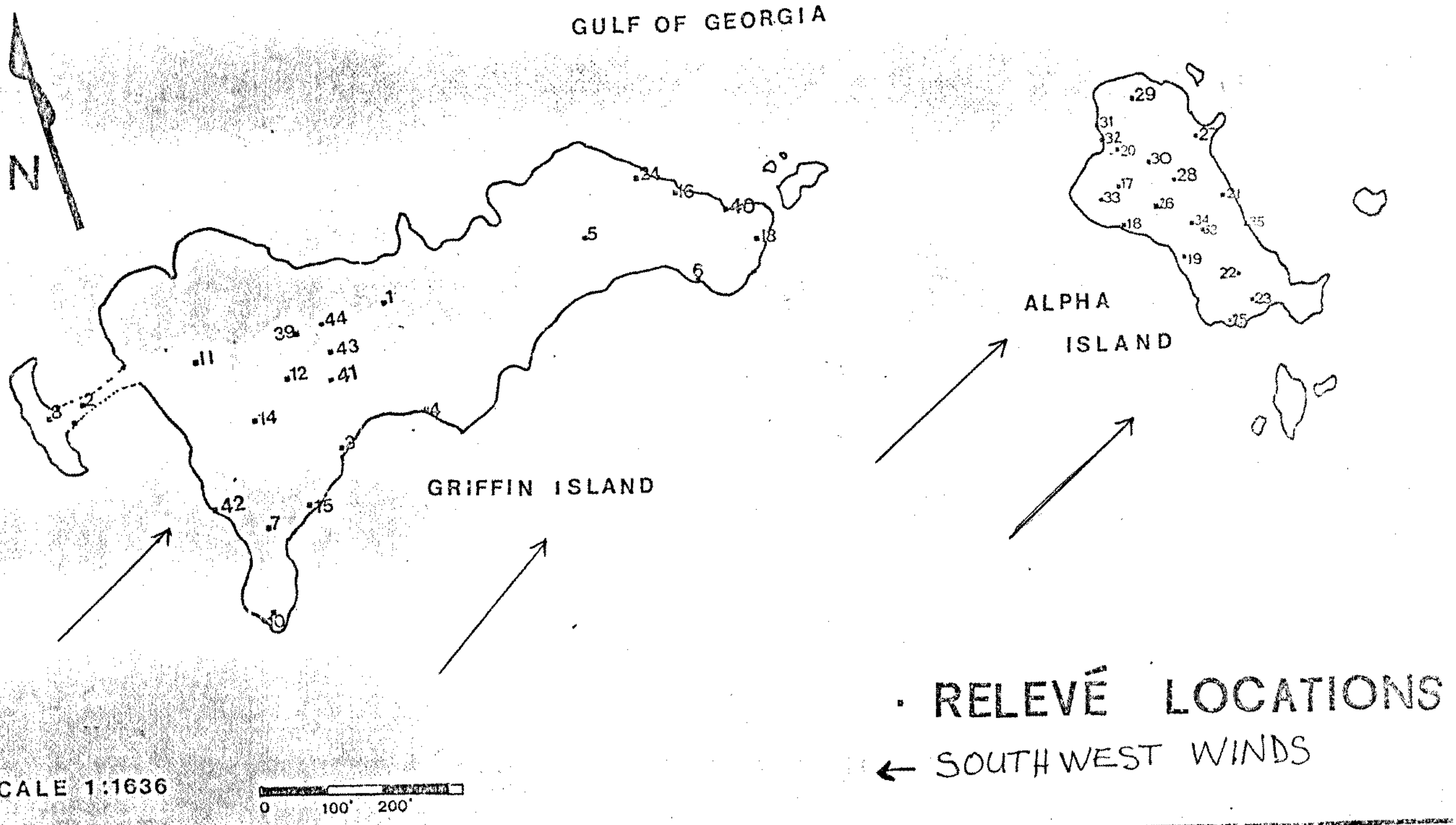
The oldest rocks in the study area are volcanic members of the Vancouver group (Clapp, 1912) formed in the lower Jurassic and upper Triassic era. These rocks were metamorphosed, faulted and fractured. Following deformation the Vancouver Volcanics were invaded by Plutonic rocks. Underlying the study area is Saanich grano-diorite bedrock. This bedrock is rich in minerals and fairly resistant to erosion.

During the late tertiary pre-glacial erosion cycle, rocks in the Victoria area were pene-plained and uplifted. Subsequent glaciations overode the study area resulting in the reduction of the peneplain. Glacial-marine drift was deposited on Alpha and Griffin Islands. The unexposed portions are covered by drift, yet the exposed areas are monadnocks (Clapp, 1912) which are fairly resistant to erosion and are abundant on the island shorelines.

After glaciation, the rebound of the depressed lowland formed the irregular coastline of Victoria and the out-lying islands. Few of the irregularities of the depressed glaciated rock surface were destroyed. However, small coves and wave chasms have been developed by wave action on the shear zones, joints and interbedded rocks. In exposed places narrow

MAP 2

ALPHA & GRIFFIN ISLANDS, VICTORIA



beaches have been cut, while in protected bays beaches of shingle occur.

On Griffin, two isthmuses with accumulating shingles connect rocky islets to the main island. Accreation of beach material, and stabilization by plants seems to be a present process. The processes of marine erosion and deposition are currently affecting the shorline of Alpha and Griffin Islands.

Soils

Soils on Alpha and Griffin show weak horizon development and lithic profiles. Soils in meadows have a sandy loam texture with dark, rich, well decomposed decomped organic matter accummulation (B. Fraser, personal communication). These soils are well drained and have a reasonable water holding capacity (see Figure 1 , Appendix 4).

Soils vary from extremely shallow Regosols in exposed crevices to Orthic Brunisols in the forested area.

Cultural History

Before European contact Coastal Salish Indians utilized the islands for digging. Camassia BULBS. Limited cultivation and burning took place. (A. Foster, M. Bell, personal communication). Less than 50 years ago Indians introduced about 6 domestic sheep to Griffin Island. At one point a Feral goat also roamed Griffin, hence the nickname "Goat Island". Griffin Island has a small cabin built by a Boys' Club many years ago (Fraser, Shepherd, S. Vanderjact, personal communication) but is currently unoccupied.

Alpha Island shows no evidence of human alteration or grazing. Families of river-otter inhabitat the island and the outer rocks are the haunt of numerous sea-birds. Due to its relatively intact nature and floral diversity, Alpha Island was proposed as part of Ecological Reserve Proposal #144 (oak Bay Islands) in 1976.

METHODS

A preliminary reconnaisance of the study area revealed seven major community types based on dominance. Minimal areas were determined for each community type (Mueller-Dombois & Ellenberg, 1974) and from these, plot sizes were established. Due to the limiting size of the 2 islets and the narrow distribution of the vegetation, plot sizes were small. In all but the tree community, plot size varied but averaged 4 m. x 3 m. Plot selection was based on a subjective interpretation of the plant patterns.

The Braun-Blanquet floristic method of vegetation sampling was used to classify the phytosociological relationship of the plant community types. According to this method 44 releves were made within the communities of Alpha and Griffin Islands and one tree stand relevé was taken from a neighbouring islet of comparable vegetation. Floristic lists collected from the releves determined an estimation of cover and species abundance according to the Braun-Blanquet 1-5 scale. Unknown plants were collected and taken to the U.Vic herbarium and Dr. Pojar for identification. Other information on slope, aspect, moisture regime, surface shape, drainage and exposure was collected on the vegetation data forms (see sample Appendix 2) and wildlife observations were noted during field work.

Soil profiles were established using soil pits and the Hellerge-Truag Soil Test Kit for pH. A measure of the organic content was made by comparing dried soil samples before and after ashing.

To evaluate the biotic effect of grazing, a comparison was made of sward plots on Alpha, Griffin and Chatham islands with relation to species composition, height of sward and biomass productivity. Vegetative productivity of the communities was assessed by weighing dry forage taken from 25 cm. x 25 cm. sample plots. Due to adverse weather conditions a 10 cm.

TABLE 1 COMPUTER PRINT OUT

```
ALPHA-GRIFFIN ISLETS 17.11.77 RUN #6                                                    REWRITING MJ ISLETS 17.11.77 RUN #6

                  | 0 0 | 0 0 0 0 0 | 0 | 0 0 | 0 | 0 0 0 | 0 0 0 | 0 | 0 | 0 0 0 | 0 | 0 0 0 | 0 0 0 0 0 | 0 0 0 0 | 0 | 0 0 | 0 0 0 0 0 | 0 | 0 |
Releve no.        | 0 0 | 0 0 0 0 0 | 0 | 0 0 | 0 | 0 0 0 | 0 0 0 | 0 | 0 | 0 0 0 | 0 | 0 0 0 | 0 0 0 0 0 | 0 0 0 0 | 0 | 0 0 | 0 0 0 0 0 | 0 | 0 |
                  | 4 4 | 1 1 2 3 4 | 3 | 0 2 | 1 | 0 0 3 | 0 0 1 | 1 | 4 | 2 2 3 | 3 | 2 2 3 | 0 1 1 3 3 | 0 1 1 4 | 0 | 2 3 | 0 1 2 2 4 | 2 | 3 |
                  | 4 5 | 1 2 0 9 3 | 3 | 2 2 | 7 | 6 8 6 | 1 7 4 | 0 | 0 | 4 7 0 | 7 | 1 9 4 | 3 5 9 2 5 | 4 6 8 2 | 9 | 3 1 | 5 3 5 6 1 | 8 | 8 |

                  | 1 1 | 1 1 1 1 1 | 1 | 1 2 | 2 | 2 1 2 | 2 1 2 | 2 | 1 | 1 1 1 | 2 | 0 0 1 | 0 0 0 0 0 | 0 1 0 0 | 0 | 0 0 | 0 0 0 1 1 | 2 | 1 |
NO. OF SSP.       | 0 5 | 8 6 0 4 9 | 5 | 7 1 | 1 | 0 7 1 | 7 3 3 | 1 | 7 | 7 6 8 | 3 | 6 7 2 | 7 7 5 3 5 | 8 4 8 4 | 7 | 7 6 | 3 5 3 6 1 | 4 | 9 |
Community type    |        1        |          2          |             3             |             4             | 5 |
           Subtype|  a  |     b     |      a      |   b   |   a   |         b         |   a   |     b     |    c    | . |

  GROUP 1
  23 VICI GIGA    | + + | 1 3 + 2   |   |     |   |       |       |   |   |       |   |       |           |     +   |   |     |           |   |   |
  31 HOLO DISC    | 3 2 | 2     3 3 |   |     |   |       |       |   |   |       |   |       |           |         |   |     |         2 |   |   |
  40 SYMP ALBU    | 1   | 2   3     |   |     |   |       |       |   |   |       |   |     1 |           |         |   |     |           |   | 2 |
  41 SALI SCOU    | 2 2 |   3   3 3 |   |     |   |       |       |   |   |       |   |       |           |         |   |     |           |   |   |

  GROUP 2         |     |           |   |     |   |       |       |   |   |       |   |       |           |         |   |     |           | * |   |
  12 ROSA NUTK    | 1   | 2 + 3 1 + | + |   R | + |       |       |   |   |     R | 1 | + + 3 |           |         |   |     |         3 | + |   |
  13 RUBU URSI    |     |   1 +     | + | R + | + |     1 |       |   |   | +     |   | + 1 1 |           |         |   |     |       +   | + | 1 |
  17 BROM SITC    |   1 | + 1 + 1 + | 2 | 4   |   |       |   2   |   |   |       | R |     1 |   R       |         |   |     | 1         |   |   |
                  |     |           |   |     |   |       |       |   |   |       |   |       |           |         |   |     |           | * |   |

  GROUP 3         |     |           |   |     |   |       |       |   |   |       |   |       |           |         |   |     |           |   | * |
  22 CAMA QUAM    |     |           | + | 1   | + | + 2 + |     1 |   |   |       |   |       |           |         |   |     | 1         |   |   |
  25 EURH OREG    | +   |         R |   |     | 2 | 2 2 + |       |   |   |       |   |     + |           |         |   |     |           |   | 1 |
  33 PTER AQUI    |     |           | 1 |     | + |     2 |       |   |   |       |   |       |           |         |   |     |       1   | + | 1 |
  42 DICR SCOP    |     |           | + |   2 | 1 |     1 |       |   |   |       |   |       |           |         |   |     |           |   | + |
  45 BERB AQUI    |     |           | 1 |     |   |     1 |       |   |   |       |   |       |           |         |   |     |       2   |   | + |
  56 FRAG VESC    |   + |           |   |     | + |     + |       |   |   |       |   |       |           |         |   |     |           | R |   |
                  |     |           |   |     |   |       |       |   |   |       |   |       |           |         |   |     |           |   | * |

  GROUP 4         |     |           |   |     |   |       |       |   |   |       |   |       |           |         |   |     |           | * | * |
   7 CERA ARVE    |     |           | 1 | + 2 | + | + 1 1 | + 1 2 | + |   | +   + | + |       |           |         |   |     |       +   | 1 | + |
   5 ACHI MILL    |     |         + |   | 2 + | 1 | 2 2 1 |   1 2 | + |   | + 1 + |   |       | R         |         |   |     | 2         | 1 | + |
  18 AIRA PRAE    |     |           |   |     |   | 1 1   | 1   + | + | + | + + 1 | 2 |       |       R   |         |   |     |           |   |   |
                  |     |           |   |     |   |       |       |   |   |       |   |       |           |         |   |     |           | * | * |

  GROUP 5
  26 SEDU LANC    |     |           |   |     |   |       | R     | 1 | 1 | 1 + 1 | 1 |       |           |         |   |     |           |   |   |
  23 ARME MARI    |     |           |   |     |   |   +   |       | 1 | + | + +   |   |       |           |   +     |   | 2   |           |   |   |
  34 GRIM ORIO    |     |           |   |     |   |       |       | 1 | 1 |   1 2 | 2 |       |           |         |   |     |           |   |   |
  57 RHAC CANA    |     |           |   |     |   |       |       |   |   | +   1 | 1 |       |           |         |   |     |           |   |   |
  58 POLY PERS    |     |           |   |     |   |       |       |   | + |     + | + |       |           |         |   |     |           |   |   |

  GROUP 6         |     |           |   |     |   |       |       |   |   |       |   |       |           |         |   | * * |           | * | * |
  14 DANT INTE    |     |           |   |     |   |       |       |   |   | + 1 R | R |   +   | +     + + | 1 + 1   |   | 2 R |           | + |   |
  19 LATH JAPO    |     |           |   |     |   |       |       |   |   |       |   | 1     | 3 2 2 + 1 | +   1 R |   |     |           |   |   |
  21 ELYM MOLL    |     |           |   |     |   |       |       |   |   |       |   | 5 4 + | 3 R 4     |     1   |   |     |           |   | + |
                  |     |           |   |     |   |       |       |   |   |       |   |       |           |         |   |     |           | * | * |

  GROUP 7
  35 ATRI PATU    |     |           |   |     |   |       |       |   |   |       |   |       |           | + + 1 2 | 2 |     |           |   |   |

  ACCOMP.SPEC.
   1 HOLC LANA    |     | 2 2   2   | 2 |   1 | + | + + 2 | + 3 2 | + | 1 | + 1 + | 1 | 1   1 | R 2   + 1 |   +     |   |     | + +   + 2 | + | 2 |
   2              |   + |   + + + 2 | + | 2 4 | + |     + | + 2 + | + | + |     R | 2 |     + |           |         | R |     | +     + + | + | + |
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belt transect could not be completed. However, aerial photographs were made to aid in the formulation of a profile sketch and vegetation map.

Information collected from research into the island's post history and climatic patterns was used to correlate the environment with present successional trends. The effect of climate on vegetation composition and structure was demonstrated by a Thornthwaite water budget chart and graph. (see appendix 3 for a detailed method of analysis).

Analysis of the floristic data was undertaken using the ceska and Roemer computer program (1971). The program sorts and aggregates similar releves and species groups. It also determines the characteristic species groups for each plant community using different sorting rules based on presence/absence percentiles. Those groups which best represented the vegetation patterns within the study area were chosen.

Table 2. Summary Differential Table

——— 50 % or more present in species group
- - - - - 30 % or less present in species group

Community Types	Inland *Salix*		*Camassia* Meadow		*Festuca rubra* Rock Crevice		*Elymus* Beach			*Atriplex* Shingle
Subtypes / Species Groups	Griffen Salix	Alpha Rosa	Developed Soil Camassia Meadow	Shallow Soil Aira praecox Meadow	Rhacomitrium Internal Rock Outcrop	Sedum Halophyte	Elymus Shrub Transition	Elymus-Lathyrus Driftwood	Elymus-Atriplex	
1) *Salix* Group	———	———								
2) *Rosa* Group		———	———			-	———			
3) *Camassia* Group			———	———						
4) *Aira* Group			- - ———	———	———	———				
5) *Sedum* Group						———				
6) *Elymus* Group						- - -	———	———	———	
7) *Atriplex* Group									———	———

RESULTS AND DISCUSSION

Species Groups

The releve data was sorted into a differential table (see Table 1 and 2) based upon seven species groups. Each group is characteristic of specific ecological requirements as determined by Hitchcock's *Flora of the Pacific Northwest* and Chapman's *Coastal Vegetation*. Those species which did not aid in the community description were omitted from the species groupings.

The *Salix* group is characteristic of fairly deep soils and mesic conditions as indicated by the tree species *Salex scouleriana* and the shrubs *Holodiscus discolour* and *Symphoricarpus albus*. The herb *Vicia gigantea* requires relatively moist conditions.

The *Rosa* group is indicative of a dryer submesic site. The shrub *Rubus ursinus* and the grass *Bromus sitchensis* are both meadowland species. These characterize a transition between the Salix tree group and the following meadowland community.

Group 3 is a distinct submesic-subzeric meadowland group as indicated by the lily *Camassia quamash*. *Dicranum scoparium* and *Fragaria virginiana* are submesic meadowland species while the fern *Pteridium aquilinum* is normally found in open fields. *Berberis aquifolium* is characteristic of submesic conditions, as is the moss *Eurhynchium oreganum*.

The *Aira praecox* group is normally found in interior rocky outcrops of subxeric, shallow soils. Both *Achillea millifolium* and *Cerastium arvense* are indicative of these conditions.

Group 5 is characteristic of salt spray affected rocky outcrops. The herbs *Sedum lanceolatum*, *Armeria maritima* and *Polygonum persicaria* are characteristically soil pocket halophytes. The mosses *Rhacometrium canescens* and *Grimmia oridima* are indicative of dry, exposed rocky conditions.

Table 3

CONSTANCY CLASSES OF CHARACTERISTICS AND ACCOMPANYING SPECIES

		Community Type	1 Inland Salix		2 Camassia Meadow		3 Festuca rubra Rock crevice		4 Elymus beach			5 Atriplex Shingle
		Subtype	a Griffin Salix	b Alpha Rosa	a Developped Soil Camassia Meadow	b Shallow Soil Aira praecox Meadow	a Rhacometrium internal Rock Outcrop	b Sedum Halophyte	Elymus Shrub Transition a	Elymus Lathyrus Driftwood b	Elymus Atriplex c	
		No. of Relevés	2	5	2	3	3	3	3	5	4	1
SPECIES GROUP	1	Salix scouleriana	2	IV								
		Vicia gigantea	2	III						1		
		Holodiscus discolour	2	III								
		Symphoricarpos albus	1	II					1			
SPECIES GROUP	2	Rosa nutkana	1	V	1	1			3			
		Rubus ursinus		II	2			1	3			
		Bromus sitchensis	1	V					1	I		
SPECIES GROUP	3	Camassia quamash		I		3						
		Eurhynchium oreganum	1	I	1	3			1			
		Pteridium aquilinum			1	1						
		Dicranum scoparium		1	1							
		Berberis aquifolium		1	1							
		Frageria virginiana		1	1							
SPECIES GROUP	4	Aira praecox				2	1	1				
		Achillea millefoliam		I	2	3	2	1	3	1		
		Cerastium arvense		2	1	2	3	2				
SPECIES GROUP	5	Sedum lanceolatum					1	3				
		Armeria maritima				1	2					
		Grimmia oridima						2				
		Rhacometrium cahescens						2				
		Polygonium persicaria						1				
SPECIES GROUP.	6	Elymus mollis							3	III	1	
		Lathyrus japonicus							1	V	3	
		Grindelia integrifolia						3	1	III	3	
SPECIES GROUP.	7	Atriplex patula									4	1
		Holcus lanatus		III		3	3	1	2	IV	1	
		Geranium molle	1	IV	1	1	3	1	1			1
		Festuca rubra		I	2	3	2	1		I	2	
		Stellaria media	2	IV	1		2	2	3			
		Cynosurus echinatus	1		2	2	2	3		II		
		Vicia americana	1	III	2	1	2	1	1			
		Hypochaeris radicata			1	2	2	3	1		3	
		Deschampsia caespitosa		II	1	2	3	1		I	1	
		Taraxacum officinale	1	IV	1		2	1		I	1	1
		Opuntia fragilis						1				

Scale

1,2,3		very rare
I	1-20%	rare
II	21-40%	low
III	41-60%	intermedia
IV	61-80%	moderately
V	81-100%	high

The *Elymus mollis* - *Lathyrus japanicus* group tolerates sandy nutrient poor zeric beach sites. *Grindelia integrifolia* is also characteristic of this condition.

Atriplex patula exists on its own, without soil on rapidly drained, shingle beaches subject to tidal inundation.

Description of Communities

Seven communities were formulated based upon the presence/absence of species groups. Since each species group occurs in more than one community type, community subtypes were designated. Because of its isolated location within the beach shingle, *Atriplex patula* was extracted from the computer sorting and made into a separate community. Transitional releves were placed at the end of the computer printout as they were not characteristic of any one community type. Cover obundance and constancy were considered to determine community types and subtypes.

1) Inland Salix Community Type

The *Salix* community is located in submesic, interior sites, 10 to 40 metres from the shore. It is characterized by species group 1 and 2 (see Table 2) and divided into the Alpha *Rosa* and Griffin *Salix* subtypes (photos 2,3).

a) Griffin Salix subtype - This community is defined by the presence of the tree *Salix scouleriana*, the shrubs *Holodiscus discolour* and *Symphoricarpus ablus*, and the herb *Vicia gigantea*. *Quercus garryana* (oak), *Arbutus menziessii* (arbutus) and *Populus tremuloides* (aspen) were also found in the releves. The dense cover story of the community supressed the understory.

The community subtype occurs on moderately drained sombric brunisolic soils of 50 cm. in depth. It is relatively protected from the severe exposure of the southwest winds. The community is protected by Alpha Island and its inland location. The productivity of this site was assumed to be very high although assessment proved to be impractical. (Appendix 5).

b) Alpha Rosa subtype - On Griffin Island the *Rosa* subtype is characterized by species groups 1 and 2 introducing the shrub *Rosa nutkana*, the trailing blackberry *Rubus ursinus* and the grass *Bromus sitchensis*. Herbs which show a high degree of constancy include *Taraxacum officinale*, *Geranium molle* and *Stellaria media*. The moss *Eurhynchium oreganum* is also prevalent. On Griffin, this subtype appears to be ecotonal between the *Salix* community and the surrounding meadow.

On Alpha Island the Rosa subtype appears without trees characterized only by wind clipped Rosa nutkona and the odd Symphoricarpos albus. This community occurs 10 to 15 metres from shore on developing brunisolic soils. Scattered appearances of Rosa nutkana and Amelanchior alnifolia within the meadow community indicate the successional spread of this subtype.

2) Camassia Meadow Community Type

This community shows great beauty and diversity in the spring. However, it is fragile. The meadow occupies the greatest area of Alpha and Griffin Islands. It is characterized by species groups 2 and 3 with rare occurences of group 4. The meadow is located 2 to 25 metres from the shore with varying degrees of exposure. It is divided into the Developed Soil Camassia subtype and the Shallow Soil Aira praecox meadow.

a) Developed Soil Camessia Meadow subtype - This community is defined by the presence of the spring flowering Camassia quamash. Other characteristic species include Pteridium aquilinum, Dicranum scoparium, Berberis aquifolium and Frageria Virginiana (see photo 4). These plants are often accompanied by those in species group 2. Occurences of the Aira praecox group indicate a transition between the meadow and rock communities. Accompanying species of high constancy are Vicia americanum, Cynosurus echinatus, Festuca rubra, Cerastium arvense and others (see Constancy Table).

Species diversity within meadow sites on Alpha and Griffin varied. Griffin meadows were dominated by grasses such as Bromus sitchensis and Holcus lanatus, while Alpha meadows showed a greater abundance of forb species such as Silene antirhina. The productivity of this community subtype was moderate. It occurs ondeveloping orthic regosols of 30 cm. in depth (see photo 5). (In this sense it is more "developed" i.e. deeper than the following subtype.) Sites are submesic to subxeric, depending on the distance from shore and drainage.

b) Shallow Soil Aira Praecox Community subtype - The Aira praecox subtype is located within meadows situated over rock outcrops. Lithic regosols support species from the Camassia group as well as Aira praecox . Archillia millifolium, and Cerastuim arvense from species group 4. Due to their more severe environment, i.e., rapidly drained, shallow soils and increased exposure, life forms are shorter. Other species of high constancy include Holcus lanatus and Festuca rubra. Due to the vernal nature of this community, characteristic spring species could not be identified. Productivity of this subtype is lower than in the developed soil.

Table 4. Summary of Location Description for Each Community

Community Type / Feature	Inland Salix	Camassia Meadow	Festuca rubra, Rock Crevice	Elymus Beach	Atriplex shingle
Slope	0%	0%	0%-5%	0%-4%	1%
Elevation	2 a 4 metres	2-3 metres	2 metres	1.5 metres	sea level
Aspect	open	open	open	open	open
Length from Sea Edge	10 - 40 metres	2 - 25 metres	0 - 30 metres	1 - 5 metres	0 - ½ metres

Table 5 Summary Table of Edaphic Features from Relevé Information

Community Type / Feature	Inland *Salix*	*Camassia* Meadow	*Festuca rubra* Rock Crevice	*Elymus* Beach	*Atriplex* Shingle
Moisture Regime	mesic → submesic	submesic → subxeric	xeric	subxeric	very xeric
Slope Position	upper slope	middle slope	upper → middle slope	upper → lower slope	lower slope
Surface Drainage	receiving → normal	normal → receiving	shedding	normal	shedding
Exposure	wind	wind	wind	wind	wind
Parent Material					
a) Shape	rounded	rounded	rounded	rounded	rounded
b) Size	74 → 250 mm	> 250 mm	> 250 mm	150 → 250 mm	> 250 mm
c) Volume	24 – 49%	> 90%	> 90%	> 20%	> 90%
d) Material	deposits of glacial marine	deposits of glacial marine mat	Bedrock	Beach shingle	beach shingle, shells
Soil:					
a) PH	6.5 → 7.5	6.0 → 7.0	7.0	7.0 → 8.0	7.0 → 8.0
b) Drainage	moderately - well drained	well drained	rapidly drained	rapid → imperfectly drained	rapidly drained
c) Type	Orthic Sombric Brunisol	orthic Regosol	lithic regosol	orthic regosol	orthic regosol
d) Depth	50 cm.	30 cm.	2 cm	—	—

3) Festuca rubra Rock Crevice community type

The Festuca rubra Rock Crevice community flourished in soil pockets. It is defined by the Aira praecox and Sedum lancedatum species groups. Rare occurences of Bromus sitchensis and Lathyrus japonicus account for the distribution of species group 2 and 6. This community type is divided into 2 subtypes based on proximity to the seashore. The Rhacometrium subtype is inland in contrast to the severely exposed Sedum Halophyte subtype.

a) Rhacometrium Internal Rock Outcrop - Aira praecox, Cerastium arvense and Achillea millefolium characterize this community subtype (see photo 7). Rhacometrium canescens, Holcus lanatus, Geranium molle Cynosurus echinatus and Cladonia lichens are constant species. Lithic regosols make up the soil of this community. Soil pockets are well to imperfectly drained depending on the microtography. This subtype is over 5 metres inland which provides it some degree of protection from saltspray and dessicating winds, however, aspect may limit plant growth. Net productivity is low although organic matter in the soil is high.

b) Sedum Halophyte community subtype - The Sedum Rock crevic community is located near the sea's edge. (see photo 8,9). This subtype is recognized by Sedum lanceolatum, Armeria maritima, Polygonum persicaria and Grimmia oridema.

These plants show a remarkable tolerance to sea, saltspray and sun. The rare appearances of Opuntia fragilus on Alpha island denotes the extreme xeric conditions of this site. Other species constant within this regime are Grindelia integrefolia, Hypocharus radicata and Plantago maritima. Depth of these lithic regosolic soils is negligible, however, ~~its~~ their organic content is high. Net productivity was low due to the sparse distribution of the community subtype on rocky sites.

4) Elmus Beach Community Type

This community is located on areas of acreating shingle, groups define specific community subtypes. These include the Elymus shrub Transition, Elymus - Lathyrus Driftwood, and the Elymus - Atriplex community subtype.

4) a) *Elymus Shrub Transition subtype* - This community subtype occurred only on Alpha Island where organic matter accummulation was sufficient to accommodate scattered shrubs within the *Elymus* community (photo 10, 11). The indicative species are *Elymus mollis* and *Rosa nutkana*. Other constant species include *Stellaria media* and *Holcus lanatus*. *Elymus mollis* is well adapted to its exposed, xeric habitat. Due to the undecomposed litter layer and imperfect drainage moisture accummulation is possible.

b) *Elymus-Lathyrus Driftwood subtype* - This community subtype occurs on both Alpha and Griffin Islands. It is differeniated from the above subtype by the appearance of *Lathyrus japonicus* and *Grindelia integrifolia*. Shingle beach composes the community substrate and scattered driftwood indicates its severe exposure to tidal inundation (Photo 12). Drainage is rapid, nutrient status is low and conditions are xeric. Productivity of this site is fairly low although biomass evaluation was high due to the perennial growth form of *Elymus mollis*.

c) *Elymus-Atriplex subtype* - This transitional community occurred where moderate tidal effects allowed for the growth of *Elymus mollis*. It is characterized by both the *Elymus* and *Atriplex* species group (Photo 13). This community is well differentiated on the Griffin isthmus. There, *Hypochaeris radicata* and *Sonchus asper* are present. Drainage is rapid and conditions are xeric.

5) *Atriplex Beach Community Type*

Atriplex patula forms an ephemeral beach community. Because of its shoreline position it is able to tolerate severe exposure, extreme tidal inundation and zeric moisture regime. Other species which have rare occurences within this community are *Geranium molle, Cakile edentula*, and *Taraxacum officinale* (Photo 14).

The Lichen Community

Exposed Rocky Outcrops support an amazing array of crustose lichens (Photo 15,16). This community should be considered separately as a non-vascular plant community. It was not classified as identification of the crustose species could not be adequately carried out.

ENVIRONMENTAL INFLUENCES ON VEGETATION

Vegetation can be expressed as a function of the soil, topography, climate and biota according to Hans Jenny's formula V=f (S, T, C, B). These environmental factors determine vegetation patterns. The vegetation of the plant communities of Alpha and Griffin Islands is discussed as a function of these parameters.

Soils and Vegetation

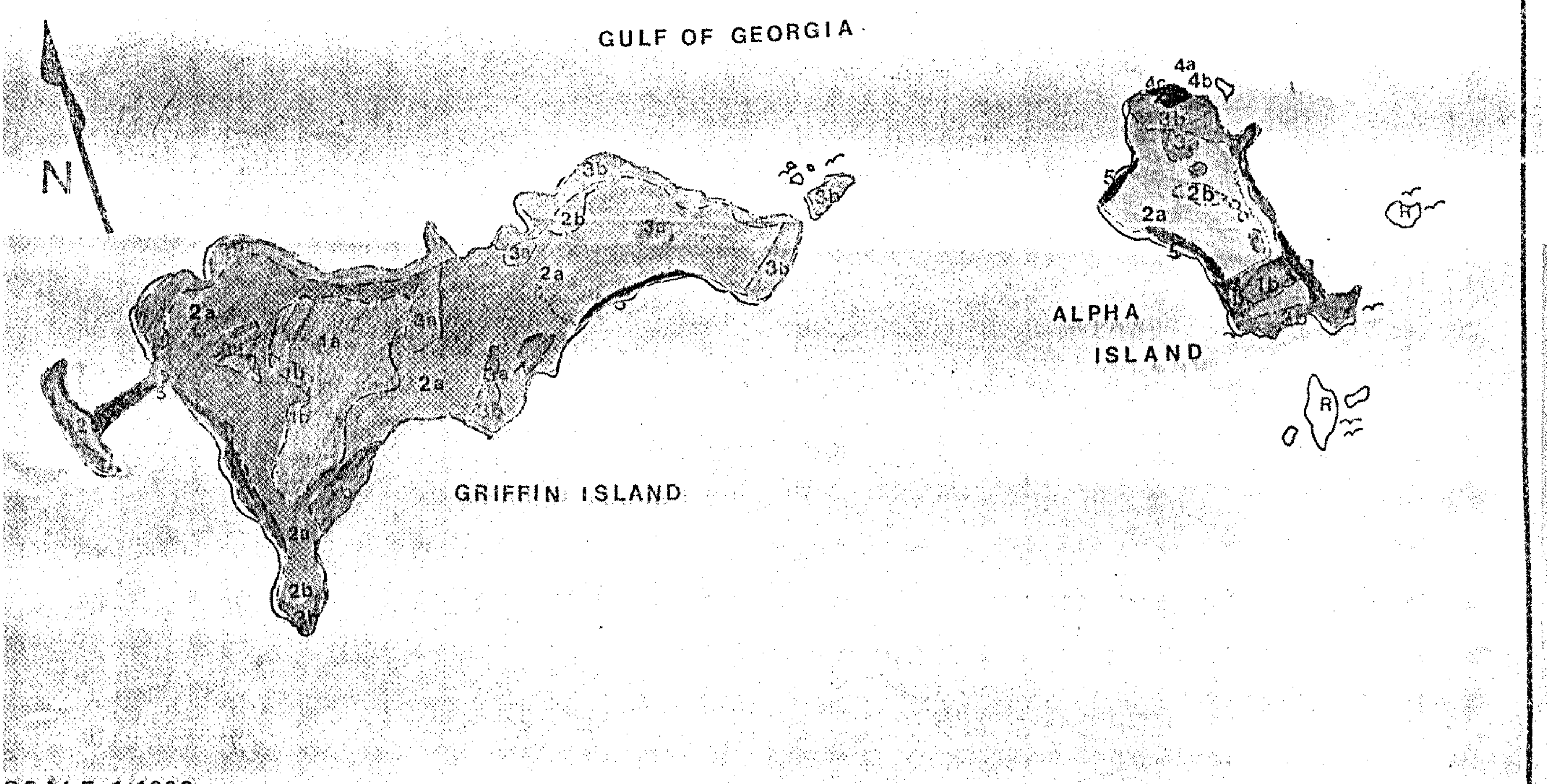
Soils are the integrating element between vegetation and the environment. The soils on Alpha and Griffin Islands are the result of weathering of bedrock and surficial material and the breakdown of organic matter over time (Photo 17).

Soil pit classification lead to the description of two soil orders:-

Regosols and Brunisols.

Regosols are well to imperfectly drained soils with good to moderate oxidizing conditions, having horizon development too weak to meet the requirements of soils in any other order (The System of Soil Classification for Canada, 1974).

ALPHA & GRIFFIN ISLANDS, VICTORIA



SCALE 1:1636

0 100' 200'

VEGETATION COMMUNITY TYPES

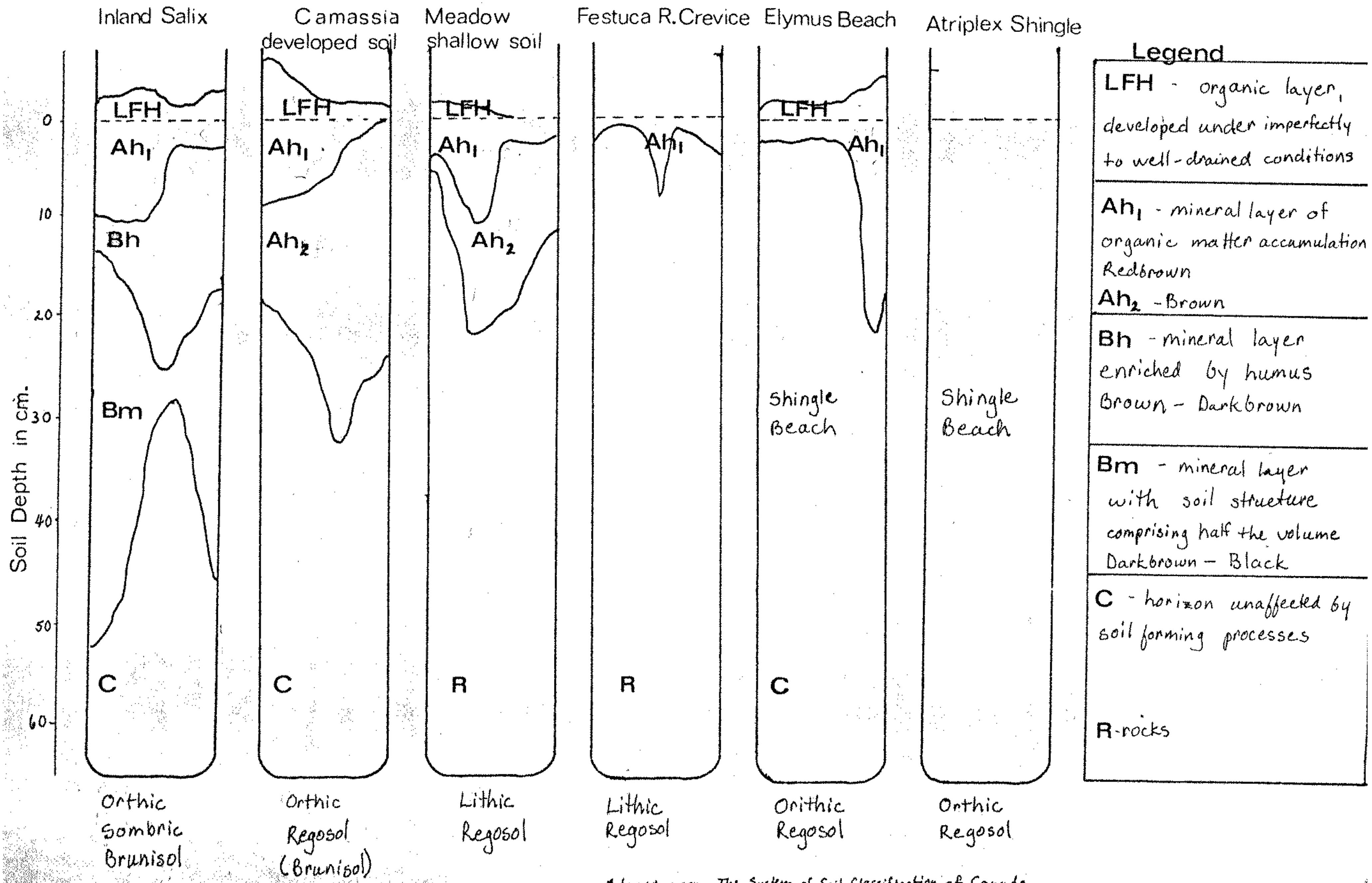
KEY

- ▨ 1a Griffin Salix
- ▨ 1b Alpha Rosa Shrub
- ▨ 2a Camassia Meadow
- ▨ 2b Aira Praecox Meadow
- ▨ 3a Rhacometrium Rock Outcrop
- ● 3b Sedum Exposed Rock
- ▨ 4a Elymus Shrub Transition
- ▨ 4b Elymus Latherus Driftwood
- ▨ 4c Elymus' Atriplex Beach
- ▨ 5 Atriplex Shingle

Otter Trails ....

Sea-Bird Haunts ~ ~

Figure 1 *Soil Profiles



* based upon The System of Soil Classification of Canada

Lithic Regosols, with a rock contact at a depth greater than 10 cm, and less than 50 cm were found in the Aira Praecox meadow community and in the Festuca Rubra Rock Crevice Community. These soils were characterized by a dark coloured, well developed Ah horizon over rock. This horizon was fairly rich in organic matter and had a sandy loamy texture. The breakdown of mineral rich granodiorite enabled tiny amounts of this soil to support life in its rocky crevices. Soil depth varied from immeasurable on exposed rock crevices to 17 cm on protected inland meadow soils. Soil depth varied with amount of organic matter breakdown, degree of exposure, and drainage conditions. As distance from shore increased, soil depth and vegetation productivity (see Figure 1) (measured by dry-forage biomass) increased. Rapid drainage and exposure to salt spray and wind subjected the shallow soils to dissication and decreased water retention capacity (Chapman, 1964). Schlerophytic and salt tolerant vegetation forms were characteristic on exposed Lithic Regosols.

Soils showed greater development on inland sites. Orthic Regosols with Ph horizons extending to the 30 cm. level characterized the Camassia meadows and the Rosa Shrub community. These soils were developed on glacial-murine deposits rather than rock. Their well developed sandy loams and high organic content support diverse and productive forbs, shrubs and grasses. Under moderate climatic conditions, mixing of humus and mineral fractions led to the development of Bh (Horizon containing more than 2% organic matter) and BM (with evidence of stronger chromas and weathering minerals) horizons. This development of soils in the Griffin Salix community and one Camassia meadow site indicated Orthis Sombric Brunisols. These well drained inland soils showed the greatest horizon and Ph differentian. The Ah layer had a Ph of 6.5 and occurred above a light reddish brown Bm layer.

The Elymus Beach and the Atriplex Shingle Communities showed the least horizonation. The Atriplex Shingle Community Type developed on rapidly drained shingle substrate with scant accumulations of organic matter. The Elymus community soils had a layer of decomposing fibric matter over sandy shingle substrate.

Topography and Vegetation

Topography affects the vegetation on Alpha and Griffin Islands in relation to slope and aspect.

Slope is important within the exposed rocky outcrop community (see Table 5). Here the community extends from sea level up to 4 metres in height (the highest point on the islands). These sloping rock walls are characterized by deep crevices which provide protection from wind and seaspray.

Aspect affects the microclimate of the plant communities in regards to wind exposure. Although the islands are exposed from all directions by sun and salt spray, dessicating wind is most prevalent on southwest facing slopes (see wind table, Appendix 3) (Photo 17b, 17c) Plant communities on these slopes, e.g. the Sedum Halophyte community type, are characterized by their adaptations to withstand such adverse condtions (Boyce, 1957). In general, due to its location, Alpha Island is more exposed than Griffin Island.

Climate and Vegetation

The Mediteranean Macro Climate has a major effect on vegetation community structure and composition on Alpha and Griffin Islands. Exposure to strong winds carrying sea spray, intense radiation, and limited precipitation are the climatic factors responsible for the abundance of sclerophytic, low-growing "wind-shaped"[1] life-forms on the islands. Alpha Island vegetation, in particular, shows a response to exposure to climatic effects. There are no trees on Alpha and existing shrubs are "wind=clipped". Halophytic (salt-resistant) species such as Armeria maritima, Spergularia rubra and Plantago

[1] "wind-shaped" plants growing at acute angles to wind direction having tight closed canopies, and an abundance of terminal shoots.

maritima grow on exposed coastal shorelines.

From compilation of the Thornthwaite Energy Budget (Appendix 3.) for 1974 and 1975 the following moisture stress effects were shown to occur on Alpha and Griffin Islands.

1) There is a net surplus of 327 mm (1975) and 260 mm (1974) of moisture (run-off) which comes in Jan., Feb., November and December (and October, 1975)

2) There is a period of soil moisture utilization when water deficit is cancelled by supplies of stored soil moisture. This period occurred in March and part of April in 1975 and in April and part of May, 1974.

3) There is a period of actual water deficit from sometime in April to October in 1974 during which the demand exceeds the supply of moisture by 425.4 millimeters. In 1975 this deficit occurs from May to November. The total net deficit totals 442.3 mm.

4) From October to February and November to March in 1974 50 mm of water is stored in the soil.

From the above results, it is clear that plant communities growing on the island are able to adapt to fairly long periods of dessication in the summer months. Dry summer winds enhance the dessication effect. The fact that the prevailing summer wind is from the South-West is reflected in the low-growing meadow and rock crevice communities on the North-East of Griffin Island and the South facing areas of Alpha. In winter the prevailing Easterly winds, although strong, are moisture laden and tend not to have the dessicating effect of summer winds.

Microclimatic variations were noted in the understory layers of the shrub and the communities. Here, moist air was trapped under the dense shrubby canopy. Vegetation was lush and non-schlerophytic in this vegetation layer.

The Biotic Effect

The biotic effects of both domestic and wild animals is apparent on the islands in the Chatham group. Historical and observational research showed that the plot on Chatham Island is heavily grazed by domestic sheep, the plot on Griffin was grazed by domestic sheep and a goat up until six years ago, and that Alpha Island has never been grazed, but is inhabitated by a colony of more than 8 river otter (Lutra canadensis).

General effects of Grazing on the Islands

Grazing indicates changes in successional patterns by altering the balance of competition among native species on the islands. Considerable damage by repeated removal of foliage from palatable species such as Cynosurus echinatus and Festuca rubra has reduced their photosynthetic capacity and subsequently root systems are dwarfed. Soil changes due to compaction, manuring and reduction of litter have occurred on grazed sites. (Daubenmire, 1968). These changes have permitted additional species to immigrate and gain footholds in the grazed areas. Seeds attached to sheep's wool drop out, germinate, colonize and compete with native species (Poore,1948). The net effect of heavy grazing is the change of vegetation to a community dominated by species, capable of regeneration and survival under grazing pressures, or unpalatable to the grazer.

Grazing and Site Productivity

Although heavy grazing degrades the site (lowering net productivity, inducing erosion problems, and diminishing native species) moderate grazing may increase theproductivity of an area. It often shifts the dominance to a tall growing species with high productivity (Daubenmire, 1968) Dactylis glomeratus and Bromus sitchenus, grasses abundant on Griffin are examples of this effect.

Grazing and Life form

The effect of grazing and trampling on plants is partially dependent on forb cover. Most palatable annuals have disappeared from Chatham and are infrequent on Griffin as they were not able to set seeds due to grazing pressures. The grasses and herbs present on Chatham withstand grazing pressures

0 - 0%
1 - 1-4%
2 - 5-25%
3 - 25-50%
4 - 50-75%
5 - 75% -100%

25 cm x 25 cm Plots

Comparable Sward Meadows

Plot characteristics	No grazing Alpha Island	Grazing 6 yrs. ago. Griffin	Heavy current grazing - Chatham	Otter trampled area - Alpha
Total # of species	20	8	6	4
Grass cover index	~~0~~ 3	4	2	3
over value Selected indicator species				
Bromus sitchensis	0	3	0	~~2~~ 0
Festuca rubra	1	0	1	0
Cynosurus echinatus	4	0	0	2
Holcus lanatus	1	4	2	3
Dactylus glomeratus	0	present nearby	0	0
Forb cover index	2	1	3	3
Cover value Selected indicator species				
Geranium molle	+	+	4	0
Cirsium vulgare	0	present nearby	present nearby	0
Stellaria media	0	4	0	4
Rumex acetosella	+	0	0	1
Erodium cicutarium	8	0	2	0
Average height of sward	35 cm	110 cm	2 cm	50 cm
Dry biomass weight of sample	147.5 g	304. 81 g.	110.78 g	112.28 g
Cover of bare soil	0 %	0%	2%	4%
Percentage Organic Matter in Soil	.0457903%		.036605 %	.071771 %
Elevation Distance from shore Slope	2 m 4 m 0%	2½ m 6 m 1%	2 m 3 m 0%	2m 4 0%

because their vegetative buds and meristems are basal (Gillam, 1956).

Plot Characteristics (see Table 7)

The sampled meadow on Chatham was characterized by an abundance of Geranium molle, Erodium cicutarium and small Holcus lanatus. The depauperate species, small biomass, and short sward height attest to the obvious denudation and site deterioration due to heavy grazing.

The effect of moderate grazing on Griffin is not so obvious. Biomass production in the lush meadows is high. However there has been an alteration of species composition. Griffin shows an abundance of tall forage grasses such as Dactylis glomeratus and Bromus sitchensis (Photo 20). These grasses are not present to any degree on Alpha. Holcus lanatus, Stellaria media, Cirsium Vulgare, Rumex crispa and Armeria maritima show a greater abundance on Griffiin than Alpha. These species are resistant to grazing and are characteristically present in grazed areas (Gillam, 1956) (photo 19).

The areas trampled and inhabitated by river otter on Griffin and Alpha show a remarkable difference in species composition when compared to adjacent areas. Otter trails were characterized by lush low growing forms of Stellaria media and Holcus lanatus (Photo 18). Stellaria is a species which becomes locally dominant in the presence of animal resting populations (Chapman, 1964).

The plant associations characterized by these "biotically affected" species are termed zooplethismic.

The rocky shores of Alpha support zooplethismic community associated with the quano deposits of sea-birds. Xanthoria candellaria and other unidentified lichens are characteristic of the sea-bird haunts. Small pools of rain-water near gull resting spots are teeming with Chlamydomonas (Dr. Jamison).

The vegetation communities and surrounding waters of Alpha and Griffin islets provide perching, nesting and feeding habitat for a multitude of bird species (see Appendix 7 and Photo 21). Crows and passeriform nests were found in the Griffin tree community.

Finches, king-fishers and a raptor; the marsh hawk were also seen perching in a dead snag in this community. Song sparrows were abundant on Alpha and seem to favor the Rosa and Elymus Community Type as it offered cover. Song sparrow nesting probably occurred in the Camassia Meadow type. Various shorebirds and marine birds favored the exposed rock communities for intertidal feeding and perching.

As vegetation has played a part in habitat requirements for the animals on the islands, the birds and mammals in turn have played an obvious part in the determination of vegetation patterns on the island.

SUCCESSION AND CLIMAX

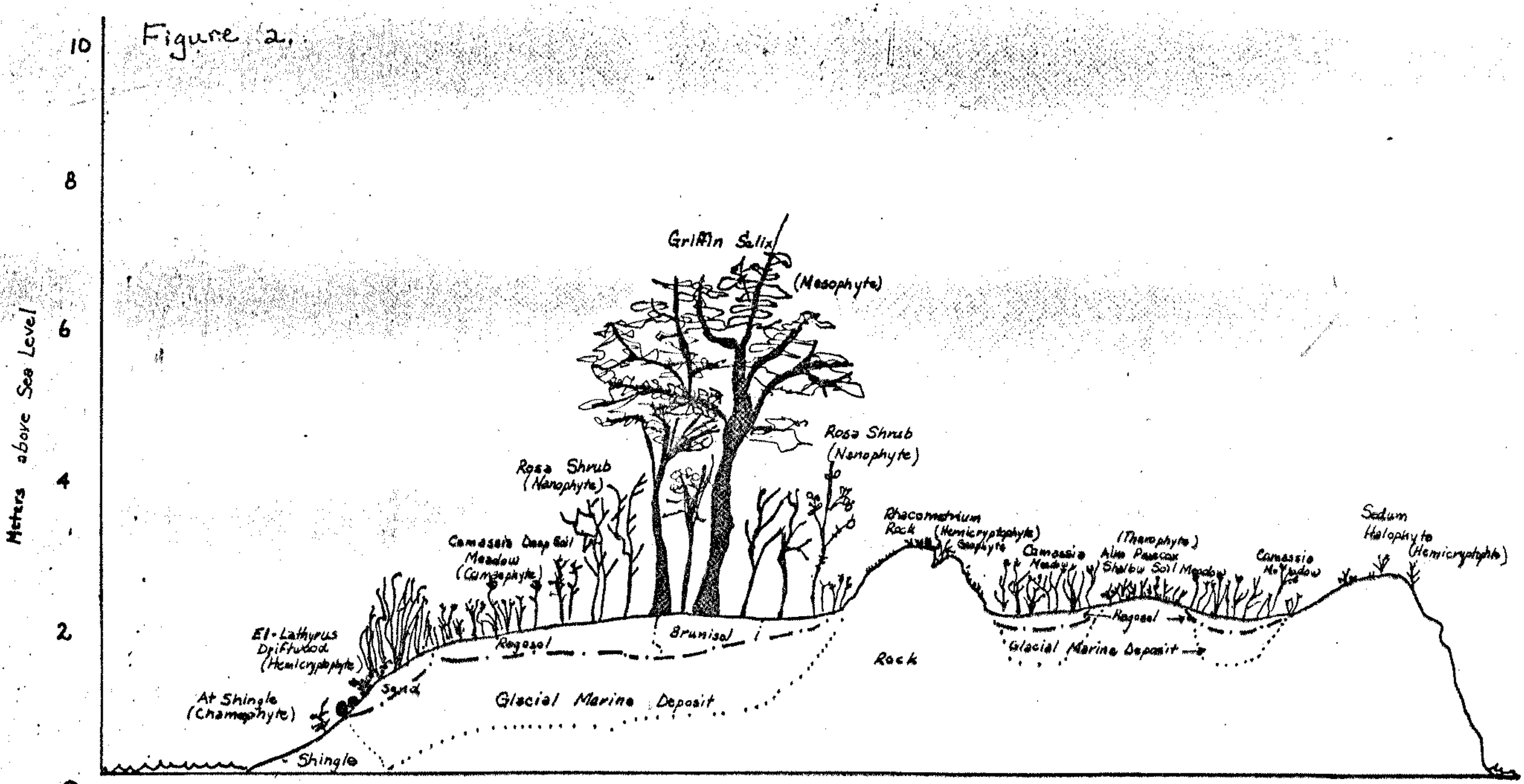
Succession is the replacement of one community by another. It is a function of the dynamic inter-relationship of the communities as they stabilize towards a climax. Evidence of succession was determined by the encroachment of one community upon another and by an increase in species diversity. The rate of succession is dependent upon the total environmental effects through time. These effects include the previously discussed edaphic features of soil depth, distance from shore and moisture regime.

The life form diagram shows primary succession. There is an overall trend from low lying chamaephytic-hemicryptophytic shore and rock crevice species to the tall, mesophytic, interior tree species. (Photo 22). This trend is differentiated into three specific edaphic climaxes which occur within the rock crevice, beach and meadow communities.

Wind born material fills the rock crevices, while creeping halophytes such as Spergularia rubra and mat forming masses such as Grimmia oridima intercept these materials to further build up the soil. As organic matter accumulates, the rock surface disappears and more plants are able to become established. Drought is the limiting factor in this community due to the continual, yet varying degree of exposure to wind and saltspray. Without sufficient rooting layer to retain moisture, the community growth is limited As a result, the climax of the community is determined by the edaphic features of the study area.

The Elymus community stabilizes beach material. By improving the habitat it ensures its own destruction by allowing superior competitors of the shrub and meadow communities to invade. The high constancy of Bromus sitchensis, Holcus lanatus and Rosa nutkana are examples of this encroachment (Photo 23). The rate of community replacement is again dependent upon the rate of organic matter accumulation and the degree of exposure.

Figure 2.



Generalized Life-Form & Community Pattern

Alpha - Griffin Study Area

The meadow community climaxes in a growth of shrub and tree species, e.g. Salix scoulerii, Symphoricarpus albus, Rosa nutkana and Amelanchier alnifolia. This form of primary succession is evident on Griffin Island. The presence of dead arbutus trees and an increase in the shrub species seems to indicate that the shrub layer may ultimately climax. While the shrub layer is increasing the tree layer does not appear to be regenerating.

Due to the limitations of size, extreme exposure and depth of soil the climax of Alpha Island consists of the shrub species Rosa nutkana. It is unlikely that trees will ever appear on Alpha Island as they do on Griffin. The substrate is particularly peculiar to produce a self perpetuating vegetation within the limits imposed by the environment.

Evidence of secondary succession is prevalent in the grazed areas of Griffin Island. There, the more fragile, slow growing forbs such as Camassia quamash have been replaced by the less palatable grass species capable of rapid regeneration, e.g. Poa pratensis (see section on Grazing Effects). Fire, too, may have functioned as a disclimax. It is thought that the native Indians burned bulb harvesting areas to encourage nutrient cycling, hence bulb growth. This would leave converted the Griffin meadow to a primary successional sequence of soil and plant growth.

In summary, succession on Alpha and Griffin Islands is observed to be a slow primary or secondary succession within which occur three distinct poly-climaxes. The vegetation is in dynamic equilibrium with its habitat.

LAND-USE ON GRIFFIN AND ALPHA

The Land Use Capability of the 5 Vegetation Communities on Alpha and Griffin was assessed by use of a grid system. Each community was assessed in light of the management options:-

1) Grazing - the introduction of 6 or more domestic sheep to each island.
2) Low Scale Harvesting of Cammasia Bulbs - includes the spring digging of bulbs, periodic burning of the island and cultivation of the soil.
3) Recreation was considered in terms of the communities aesthetic appeal, ability to attract and withstand activities such as picnicing, walking about on the islands, and beach oriented activities.
4) Non-consumptive use - includes communities potential for research, nature study, and wildlife habitat.

Ratings of High, Moderate, and Low Capability were assigned to the activities possible within the described communities. If an activity did not correspond with a vegetation unit it was rated, Not Applicable N/A.

Environmental variable which had a direct link with the proposed activity were weighed in the analysis. Plant fragility assessed by considering; a) the sensitivity of the community to disruption, b) natural diversity, c) abundance of this particular community, and d) function of this community in the overall eco-system, was weighed heavily in the anlysis.

The outcome of the grid analysis is the summary of considerations, benefits, and limitations of the various management options. These considerations are presented in the final column of the grid.

It can be seen from the grid analysis that:

1) The Camassia Meadow Community has the highest overall capability of all units but land-use in this community presents many constraints due to vegetation fragility.
2) The most universally suitable land-use on the islands is non-consumptive. This use rates moderately high throughout the five communities, presents the fewest management constraints, and the most benefits.

Diverse, intact marine associated meadows such as those found on Alpha and Griffin Islands are infrequent and diminishing habitats within the Vancouver Island and Canadian area. This factor alone validates protection

Table 6. Land-use Capability Chart – Alpha & Griffin Islands.

ssible Land- Use Community Type	GRAZING (Introduction of 6+ Domestic Sheep)	HARVESTING of CANASSIA BULB (Cultivation / Burning)	RECREATION Appeal, Tolerance of Day Use Activities Picnicking + Walking	NON-CONSUMPTIVE USE (Research, Nature Study, Wildlife Habitat)	Use Interaction	MANAGEMENT CONSTRAINTS, CONSIDERATIONS + BENEFITS
I Salix - Inland Tree Community a Griffin Tree Sub-Group b Alpha Rosa	LOW	N.A.	Moderate - Low Appeal Moderate High Abilility to With Stand Use	LOW to MODERATE	Recreation Non-consumptive	Tree and shrub communities are stable and can tolerate reasonable use levels. However, they have minimal attraction to recreationalists due to dense nature Many passerines have nesting and feeding habitat in these community types. There is the opportunity to study animal - habitat relationships
II Canassia Meadow a) Deep soil Camassia meadow b) Aira Praecox Shallow Soil Meadow	MODERATE to HIGH	HIGH	LOW - MODERATE	HIGH	GRAZING BULB HARVESTING RECREATION NON-CONSUMPTIVE	Moderate grazing in this community will lead to altered successional patterns, changes in floristic composition, diversity & function. Severe grazing will lead to drastic species alteration, reduction in no of Species and productivity. Soil erosion may be a problem. Availability of Water is a constraint Cultivation & Burning may alter floristic composition favoring bulbs and forb type flowers. Site deterioration may result from over harvesting Seasonably able to tolerate use pressures. In spring meadows are extremely attractive yet are susceptible to trampling damage ? - ?: site deterioration (Meadow) Species diversity and occurance of rare species favors perpetuation and study of this diminushing community.
III Festuca Rubra Soil Crevice a) Bracomitrium Rock Crevice b Sedum Exposed Rock outcrop.	LOW	VERY LOW to NIL	LOW	MODERATE To HIGH	NON-CONSUMPTIVE	Rock outcrops provide nesting and perching areas for seabirds. This community provides opportunities for study of halophyte communities. Existance of geographically rare plants (Opuntia fragilis) may indicate edaphic adaptions of this community, that are worthy of study.
IV Elymus Beach Community a) Elymus Rosa Transition b) Elymus Lathyrus Beach c) Elymus Atriplex Shingle	LOW	N.A	Low Attraction Moderate Ability to Withstand Use.	MODERATE	NON-CONSUMPTIVE	Opportunities for studies of sandy-soil maritime successional patterns. Song sparrows and river otters frequented this community
V Atriplex Shingle.	N.A.	N.A.	HIGH	MODERATE	RECREATION NON-CONSUMPTIVE	Beach holds attraction for picnickers, boaters etc. It is fairly tolerant of use, Opportunity for study of developing beach landforms.

status or use restrictions for the islands.

The Ecological Reserve Program in British Columbia preserves representative and unique ecosystems throughout the province. The incorporation of both Griffin and Alpha into the Ecological Reserves Program would protect these sites as well as enhancing future maritime research possibilities. Wildlife habitat relations, autecological requirements of halophytic species, the development of maritime island ecotypes, and the biogeographical distribution of the plant species are topics warranting future research on these islands. Perhaps the single most important reason for protecting the islands under the Ecological Reserves Act is to preserve natural baseline areas for the comparison with the surrounding "man-altered" and urbanized area.

CONCLUSIONS

The vegetation of Alpha and Griffin Islands is described by seven major community types characterized by their dominant species, e.g. *Salix scoulerii*, *Camassia quamash*, *Festuca rubra*, *Elymus mollis* and *Atriplex patula*. These communities are divided into nine community subtypes based upon topography, moisture regime and their corresponding floristic variations.

The *Salix* community is divided into the Griffin *Salix* and Alpha *Rosa* subtype. This community had the greatest productivity. A well developed soil profile reflects mesic conditions and its interior position enables protection from exposure to saltspray and southwest winds.

The *Camassia* meadow community is divided into the Developed Soil *Camassia* meadow and the Shallow soil *Aira praecox* meadow. Depth to root restricting layer and moisture are the main edaphic features which determine vegetation distribution in this community.

The *Festuca rubra* Rock Crevice community is divided into the Aira praecox Internal Rock Outcrop and the *Sedum* Halophyte Communities. Vegetation patterns directly reflect the effect of distance from shore as it relates to the degree of exposure and moisture regime.

The *Elymus* beach is divided into the *Elymus* shrub Transition, *Elymus* Driftwood and *Elymus*-*Atriplex* groups. This community reflects the transition from developed soil to shingle beach as one community subtype encroaches upon another.

The ephemeral *Atriplex patula* beach community exists somewhat isolated. The shingle beach is characterized by a lack of soil, xeric moisture regime and extreme exposure to both wind and tidal inundation.

The vegetation map shows the distribution of community types within the study area. This distribution reflects the various maritime climatic and edaphic features; the most important being distance from shore, soil depth and moisture regime. Successional patterns and productivity of these community types are dependent upon these features. Three successional sequences were observed on the shingle, rock outcrop and glacial marine substrates. Alterations within these primary successional patterns were due to the biotic effects of grazing and river otter inhabitation.

Due to the fragile and unique nature of the plant communities on Alpha and Griffin Islands, it is recommended that they be included within the ecological reserve program of British Columbia.

SUMMARY

1) A vegetation analysis of Alpha and Griffin Islands, Victoria, B.C. was conducted during the fall of 1977.

2) The purpose of the study was to describe and classify the vegetation and environmental features of Alpha and Griffin Islands, to correlate selected environmental and cultural features within the vegetation communities, to assess relative productivity, to examine biotic effects and to make land management recommendations.

3) The five vegetation community types described and mapped were: the Inland Salix, the Camassia Meadow, the Festuca rubra Rock Crevice, the Elymus Beach and the Atriplex Shingle Community.

4) Each of the above community types can be recognized by the presence/absence of species groups in Table 2.

5) The maritime associated vegetation of Alpha and Griffin islets reflected the environmental factors of climate, topography, substrate and biotic effects.

6) Distribution of the communities was related to moisture regime, soil depth and distance from shore.

7) Primary succession from the beach and halophyte communities to the tree-shrub communities was interrupted by past grazing, and current river otter trampling.

8) It is recommended that Alpha and Griffin Islands be included within the Ecological Reserve program of British Columbia.

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APPENDIX 1

SPECIES LIST

Compiled October, 1977

Alpha Island

Achillea millefolium
Agrostis alba
Agrostis palustris
Aira caryophylla
Aira praecox
Amelanchier alnifolia
Angelica lucida
Armeria maritima
Arrenatherum elatior
Atriplex patula
Berberis aquifolium
Brachythecium sp.
Bromus sitchensis
Camassia quamash
Cerastium arvense
Cladonia furcata
Cynosurus echinatus
Cladonia sp.
Deschampsia caespitosa
Dicranum fuscesens
Dicranum scoparium
Elymus mollis
Elymus glaucus
Eriophyllum lanatum
Eurhynchium oreganum
Festuca bromoides
Festuca dertonensis
Festuca rubra
Frageria Virginiana
Galium trifidum
Geranium molle
Grimmia maritima
Grindelia integrifolia
Grimmia oridima
Habenaria greenei
Holcus lanatus
Hypochaeris radicata
Isothecium spiculiferum
Lathyrus japonicus
Lomatium dissectum
Lupinus sp.
Nemophila parviflora
Opuntia fragilis
Plantago maritima
Phleium pratense
Plagiobothyrus scouleriana
Poa scabrella
Poa pratensis
Pferidium aquilinum
Pucinellia pumula
Rosa nutkana
Ranunculus occidentalis
Ranunculus californicus
Rubus ursinus
Rumex acetosella
Sanicula arctipoides
Sanicula crassicaulis
Sedum lanceolatum
Silene antirrhina
Solidago canadensis
Spergularia rubra
Stellaria media
Symphoricarpos albus
Trifolium spp.
Vicia gigantea
Vicia americana

SPECIES LIST

Compiled October, 1977

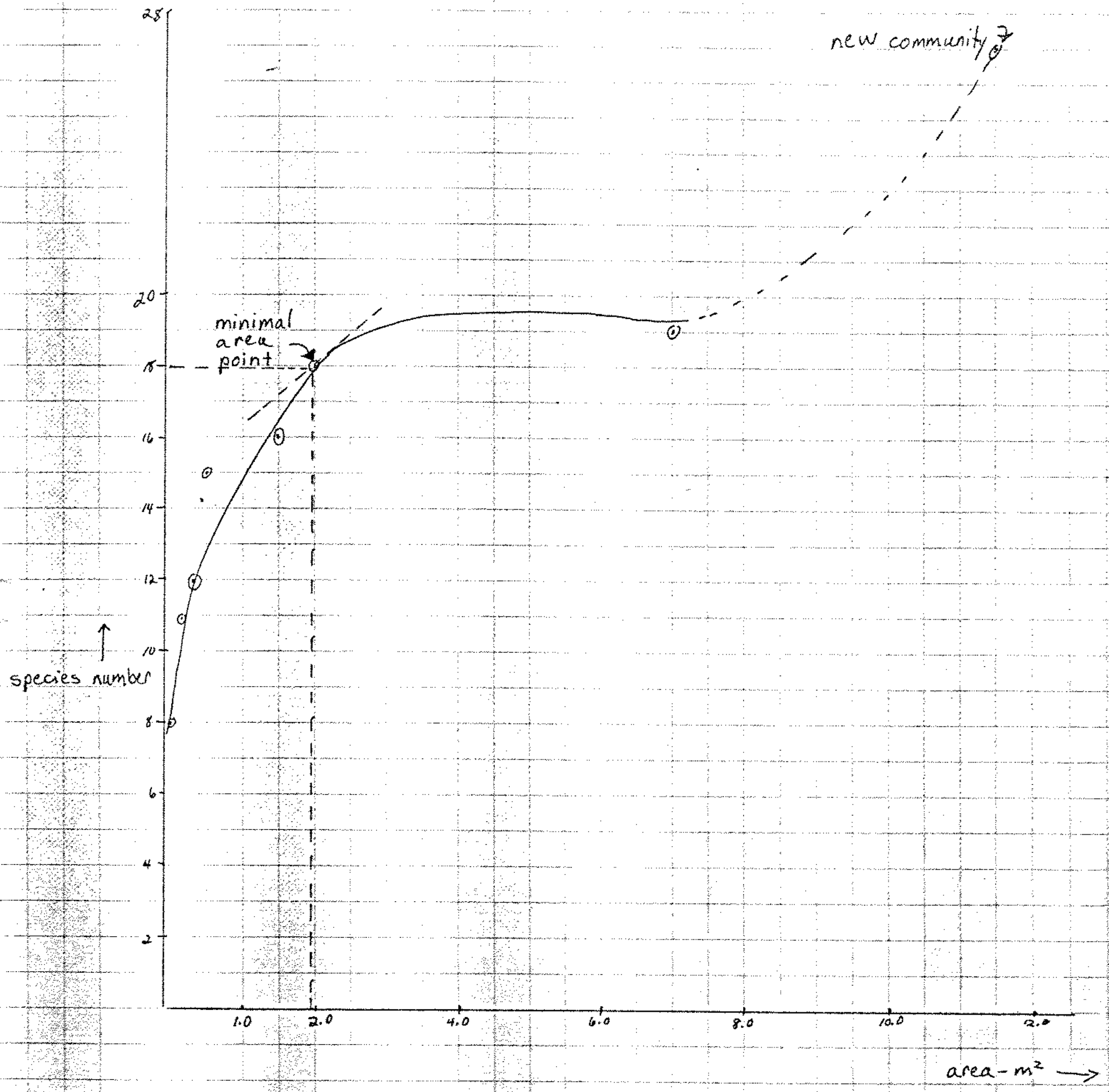
Griffin Island

Achillea millefolium
Agrostis alba
Agrostis sp.
Aira caryophyllea
Aira praecox
Amelanchier alnifolia
Anaphalis margartacea
Angelica lucida
Arbutus menziesii
Armeria maritima
Atriplex patula
Bromus pacificus
Bromus sitchensis
Bryum sp.
Cakile endentula
Calamagrostis elegans
Calamagrostis canadensis
Camassia quamash
Cerastium arvense
Cirsium vulgare
Cladonia furcata
Cladonia sp.
Cynosurus echinatus
Dactylis glomeratus
Deschampsia caespitosa
Dicramum scoparium
Elymus glaucus
Elymus mollis
Erodium cicutarium
Eurhynchium oreganum
Festuca dertonensis
Festuca megalura
Festuca rubra
Franseria chamissonis
Fritillaria lanceolata
Galium tritidum
Geranium molle
Grindelia integrifolia
Holcus lanatus
Holodiscus discolor
Horium brachyantherum
Hypochaeris radicata
Ilex aquifolium
Isothecium spiculiferum
Juncus balticus
Lathyrus japonicus
Lepidium virginicun
Lomatium dissectum
Lonicera involucrata
Luzula campestris
Osmorhiza chilensis
Plageobothyrus scouleriana
Plantago lanceolata
Poa macrantha
Poa pratensis
Polygonium persicaria
Plytrichum juniperum
Populus tremuloides
Quercus garryana
Ranunculus occidentalis
Rhacometrium canescens
Rosa nutkana
Rumex acetosella
Rumex crispus
Salix scouleriana
Sanicula crassicaulis
Selaginella wallacei
Sonchus asper
Spergularia rubra
Stellaria media
Stellaria numifura
Symphoricarpos albus
Taraxacum officinale
Trifolium repens
Vicia americana
Vicia gigantea

Figure

Minimal Area of Ford Meadow Community on Alpha Island

as determined by Trudy Carson, Bill Hubbard, and Lynne Milnes Oct 5/1977



Minimal Area = 1.5 → 2.0 m²

0017 = releve number
0117

VEGETATION DATA FORM

(Second Draft — January, 1976)

NUMBERS 1-17 MUST BE RECORDED FOR EVERY PLOT. FOR DESCRIPTION OF DATA TERMS SEE V.D.F. EXPLANATION SHEET.

1a. Project Identification Alpha Islet.
1b. Sampling technique B & B
2. Name of surveyor(s) and agency T. Carson Lynne Milnes Bill Hubbard
3. Plot number CM1
4. Date Oct. 5/77
5. Latitude 48 ° 26 ' 00 " N
6. Longitude 123 ° 17 ' "
7. Topographical map 92B 6/g.
8. Plot size 16 m² 4x4 m²
9. Location description middle Alpha Islet, East of Chatham Island N. of Discovery Island.
10. Slope 0 - ½ (°/%)
11. Elevation 1½ m (meters/feet)
12. Aspect - Slighty South west open
13. Distance from shore ~~Length upslope~~ 5 m (meters/feet)

14. Moisture regime:
- a. hydric
  - i. hydric
  - ii. subhydric
- b. hygric
  - i. hygric
  - ii. subhygric
- c. mesic
  - i. mesic
  - ii. submesic
- d. xeric
  - [✓ i. subxeric]
  - ii. xeric
  - iii. very xeric

15. Slope position macro:
- a. apex
- b. face
- c. upper slope
- [✓ d. middle slope]
- [✓ e. lower slope]
- f. valley floor
- g. plain

16. Surface shape:
- a. smooth convex
- b. irregular convex
- c. smooth straight
- [✓ d. irregular straight] Slight
- e. smooth concave
- f. irregular concave
- g. smooth flat
- h. irregular flat

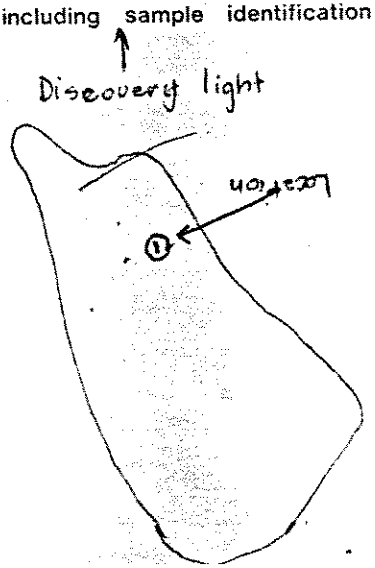
17. Slope position moisture:
- a. shedding
- b. normal
- [✓ c. receiving]
- d. collecting
- e. seepage

18. Exposure type:
- [✓ a. wind]
- b. insolation
- c. frost pocket
- d. cold air drainage
- e. (other)
- f. not applicable

19. Site type Grass-Forb meadow Cynoceros echinata
20. Climatic climax zone/subzone Dry CDF a
21. Successional trend Stable - (towards shrub)
22. Relative rate of succession Sub-climax
23. Cause of stand establishment Seed dispersal wind bird
24. Present land use Recreational - Wildland
25. Plot representing Grass - Forb
26. Miscellaneous comments: (including sample identification of associated determinations)

Veg. 1/76

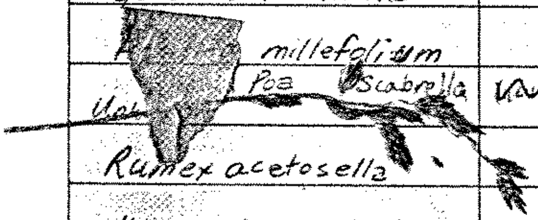
B+W. Photo 13

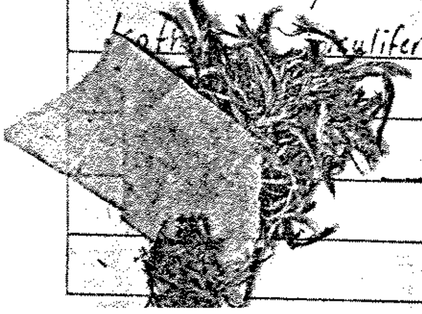


N ↓

Appendix 2 Data obtained for minimal area

Species	area m²	number of species
Cynosurus echinatus		
Geranium molle		
Achillea millefolium		
Hypochaeris radicata		
Rubus ursinus		
Vicia gigantea		
Lomatium dissectum		
Eurhynchium oreganum	1	8
Rumex acetosella		
unknown grass		
Rosa gymnocarpa	2	11
Festuca rubra	4	12
Ellymus mollis		
Dicranum fuscesens		
cladonia spp.		
Cerastium arvense	16	16
Calamagrostus candensis		
Rosa nutkana		
Bromus sitchensis		
Holcus lanatus		
Stellaria media	64	21
Grindelia integrefolia		
Festuca rubra		
Lathyrus japonicus		
aira caryophylla		
Bromus spp 2.		
Festuca bromoides		
Aira praecox	128	28





27. Floristic List	STRATUM												Quantity		
	Cover, . cm														
	VETERAN	A1	A2	A3	Total trees	B1	B2	Total shrubs	C	D	Seedlings	All strata	Epiphytes	Epiliths	Epixyles
Height of top of strata (m/ft.)							20		40	1					
Number of dead snags															
Total vegetation 100%							2%		100%	30%		100%			
3₂ Rubus ursinus							1% ~~1~~/+								
Rosa nutkana ~~gymnocarpa~~							1/+								
Cynosurus echinatus						10/2	10/2	15/2	70/4			70/4			
Geranium molle									1/+			1/+			
[illegible] millefolium									3/1			3/1			
[illegible] Poa scabrella ~~[illegible]~~ (?)									>1/r			>1/r			
Rumex acetosella									1/+			1/+			
Hypochoeris radicata									5/1			5/1			
Fragaria vesca ~~[illegible]~~									1/+			1/+			
Vicea ~~[illegible]~~ americanus									>1/r			>1/r			
Camassia ~~sp~~ quamash ~~Castilleja sp~~									>1/+			>1/+			
Habenaria ~~sp~~ greenei									>1/r			>1/r			
Holcus lanatus									>1/+			>1/+			
Eriophyllum lanatum									>1/+			>1/+			
Pteridium aquilinum									>1/+			>1/+			
Cerastium arvense									>1/+			>1/+			
Lomatium ~~dissectum~~(?) dissectum ~~Lomatium sp. (dissectum)~~									>1/+			>1/r			
I Elymus glaucus									>1/r			>1/r			
C Eurhynchium oreganum.		?							~~20/2~~	10/2		10/2			
Dicranum scoparium.									~~5/1~~	5/1		5/1			
Isothe[illegible] [illegible]uliferum										15/2		15/2			
— Brachy thecc															

parent material bedrock coarse granodiorite

28. Substrate	% Grd. Cover	Thickness (cm/in.)	Type
Humus (L–F–H)	100	1cm	mostly grass moss fragment
Decaying Wood	—		
Bedrock	—		
Rocks	—		
Mineral Soil	—		

29. Parent material texture:
finer soil fragments (<2 mm)

- A. coarse
  - a. coarse
    - i. s
    - ii. ls
  - b. moderately coarse
    - i. sl
- B. medium
  - a. medium
    - i. l
    - ii. sil
    - iii. si
- C. fine
  - a. moderately fine
    - i. scl
    - ii. cl
    - iii. sicl
  - b. fine
    - i. sc
    - ii. c
    - iii. sic
  - c. very fine
    - i. hc
- D. organic
  - a. organic
    - i. fibric
    - ii. mesic
    - iii. humic

30. Parent material texture:
coarser soil fragments (>2 mm)

- a. shape
  - [✓ i. rounded]
  - ii. angular
  - iii. thin, flat
- b. size
  - i. 2–74 mm
  - ii. 75–149 mm
  - iii. 150–250 mm
  - [✓ iv. >250 mm]
- c. volume
  - i. <20%
  - ii. 20–49%
  - [✓ iii. 50–90%]
  - iv. >90%
- d. type
  - i. mixed
  - ii. (other) —

31. Parent material salinity:

- a. saline
  - i. weakly
  - ii. moderately
  - iii. strongly
- b. not saline

32. Parent material calcareousness:

- a. calcareous
  - i. weakly
  - ii. moderately
  - iii. strongly
- b. not calcareous

33. Parent material acidity:
pH________

34. Soil drainage:

- a. rapidly drained
- [✓ b. well drained]
- c. moderately well drained
- d. imperfectly drained
- e. poorly drained
- f. very poorly drained

35. Landform Rocky Islet

36. Bedrock type granodiorite

37. Depth to lithological discontinuity 30 cm.

38. Depth to root restricting layer 30 cm.

39. Soil development well

40. Soil association/member Brunisol
Lithic Sombric Brunisol

41. Soil profile description:

Horizon	Depth (cm/in.)		Texture	Volume of Coarse Fragments	Colour	Comments (structure, pH, pan, etc.)
	Upper	Lower				
L	.3	.2cm				
F	—	—	Sandy loam			
H	.2	.2				Shallow to bedrock
Ah	0	5 cm		5%	[redacted]	
B	5cm	~~15~~20		15%	[redacted] A smor	6
B/C	20	30cm		50%		
					[redacted] B	6

42. Tree mensuration data: no trees

Species				
Horiz. distance (m/ft.)				
Top reading				
Bottom reading				
Height (m/ft.)				
Total height				
Boring height				
Age				
Total age				

Prism number				
No. of trees				
BASAL AREA				
S.I. 100				
S.I.				

WATER BUDGET

ALPHA & GRIFFIN (in mm. calculated on a month. basis.

1975 (mm)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept.	Oct.	Nov	Dec
Precipitation	129.0	95.0	27.6	17.0	21.8	6.1	4.3	65.8	6.9	113.5	163	181
Potential Evapotranspiration	0	0	41.23	64.8	97.8	106.2	152.5	70.37	75.0	4.65	0	0
Gross Surplus P-PE	129	95								108.85	163	181
Gross Deficit P-PE			13.63	64.7	76.0	100.1	148.22	4.57	68.1			
Net Surplus	79	45								58.85	113	131
Net Deficit				28.3	76.0	100.1	148.22	4.57	68.1			
Soil Moisture at End of Month	50	50	0	0 ~~28.3~~	~~70~~	0	0	0	0	50	50	50
Storage	50	50	36.4	-0	0	0	0	0	0	50	50	.50

1974 mm	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec
Precipitation	160	90	54	30	24	29	31	1.0	5.0	23	96	114.3
Potential Evapotranspiration	0	0	27.9	51.0	82.46	110.0	125.55	130.2	78.3	57.66	0	0
Gross Surplus P-PE	160	90	26.1								96	114.3
Gross Deficit P-PE				21.0	68.46	81.0	94.55	129.2	73.3	34.66		
Net Surplus.	110	40									46.0	64.3
Net Deficit					29.46	81.0	9.55	129.2	73.3.	34.66		~~5~~
Soil Moisture at End of Month.	50	50	50	29.0	0	0	0	0	0	0	50	50

N.B 50 mm. was used as the soil storage capacity as. the average soils on Alpha & Griffin are not deeper than 30 cm. and and using (pasture) of moisture used up by evaporation and transpiration if adequate moisture is avilable. This potential demand for moisture and Potential evapotranspiration was calculated using a method devised by Dr. R. Wilson of the Resource Analysis Branch.

Potential energy in mm/day was calculated in series of steps using the following formula:

Potential Energy = 1.26 LE (Latent Heat Flux)

? Latent Heat Flux, = $1.26 \quad s/\underset{\alpha}{\cancel{s}}\cancel{+} \quad (Q^* - G)$

were

Q^* = net radiation derived from .72 (Rs-86) where
Rs= radiation received during one month
(cal/CM^2/day

G = soil heat flux (on grass) = 5% of Q^*

? S/S + ? = an energy term derived from applying the mean monthly temperature to Table 9 (Weighting factors for Energy terms in Penman's Formulla)

The 30 day value for Potential Energy was entered into Thornthwaite's Table and compared with the Moisture Supply to give an indication of the energy budget and plant moisture stress in the Griffin and Alpha environment. It should be realized that the evaporation from Plant Surfaces will be less than Potential Evapotranspiration in certain months of extreme moisture stress. As soil storage nears minimum, soil moisture is retained in the deeper layers and remains available to plants that control evapotranspiration. Therefore the moisture deficit shown by the graph is quite as severe as shown.

The results of the Energy Budget are presented in Graphs 1 & 2.

APPENDIX 3.

CLIMATE - METHOD

The study of the vegetation of Alpha and Griffin Islands began with an investigation of the physical factors affecting the ecosystem on the island Climatic data was collected for the years 1974 and 1975. Monthly radiation data was taken from the nearest recording station at Nanaimo, B.C. Mean monthly temperatures and precipitation totals are gathered from Gonzales Hill, Victoria records. Average monthly wind speed was taken from Discovery Lightstation records - ½ mile from Alpha and Griffin Islands.

Compilation of Energy Budget for Alpha and Griffin

The water balance on Griffin and Alpha was determined by comparison of the supply of moisture available to the soil and plants, and the demand for moisture (principally evaporation from the soil and transpiration by plants). The supply of moisture is equal to the total precipitation falling on the islands. The total supply of moisture at the end of any one month depends on

a) current demand for moisture,

b) the part of the supply that is not needed during the month and can be stored in the soil,

c) the part not used or stored (runoff) as surface or sub-surface drainage.

Supply of moisture at the end of the month (See Table) is calculated by adding totals precipitation plus any moisture available from the soil. Soil Storage on Alpha was estimated to be 50 mm. (The soil on Alpha/Griffin had an average depth of 30 cm and is generally fine loam. Using Table 10. Soil in this category, with grassland vegetation, has a soil moisture retention value of 150 cm/metre.)

The demand for water consists of evaporation from the ground surface ? and transpiration by plants. Potential ipotranspiration is the amount of of moisture used up by evaporation and transpiration if adequate moisture is avilable. This potential demand for moisture and Potential evapotranspiration was calculated using a method devised by Dr. R. Wilson of the Resource Analysis Branch.

Potential energy in mm/day was calculated in series of steps using the following formula:

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Latent Heat Flux, = $1.26 \quad s/\underset{\alpha}{\cancel{s +}} \quad (Q^* - G)$

were

Q^* = net radiation derived from .72 (Rs-86) where
Rs= radiation received during one month (cal/CM^2/day
G = soil heat flux (on grass) = 5% of Q^*

S/S + = an energy term derived from applying the mean monthly temperature to Table 9 (Weighting factors for Energy terms in Penman's Formula)

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Net Deficit				28.3	76.0	100.1	148.22	4.57	68.1			
Soil Moisture at End of Month	50	50	0	0 ~~28.3~~	~~10~~	0	0	0	0	50	50	50
Storage	50	50	36.4	-0	0	0	0	0	0	50	50	.50

1974 mm	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec
Precipitation	160	90	54	30	24	29	31	1.0	5.0	23	96	114.3
Potential Evapotranspiration	0	0	27.9	51.0	82.46	110.0	125.55	130.2	78.3	57.66	0	0
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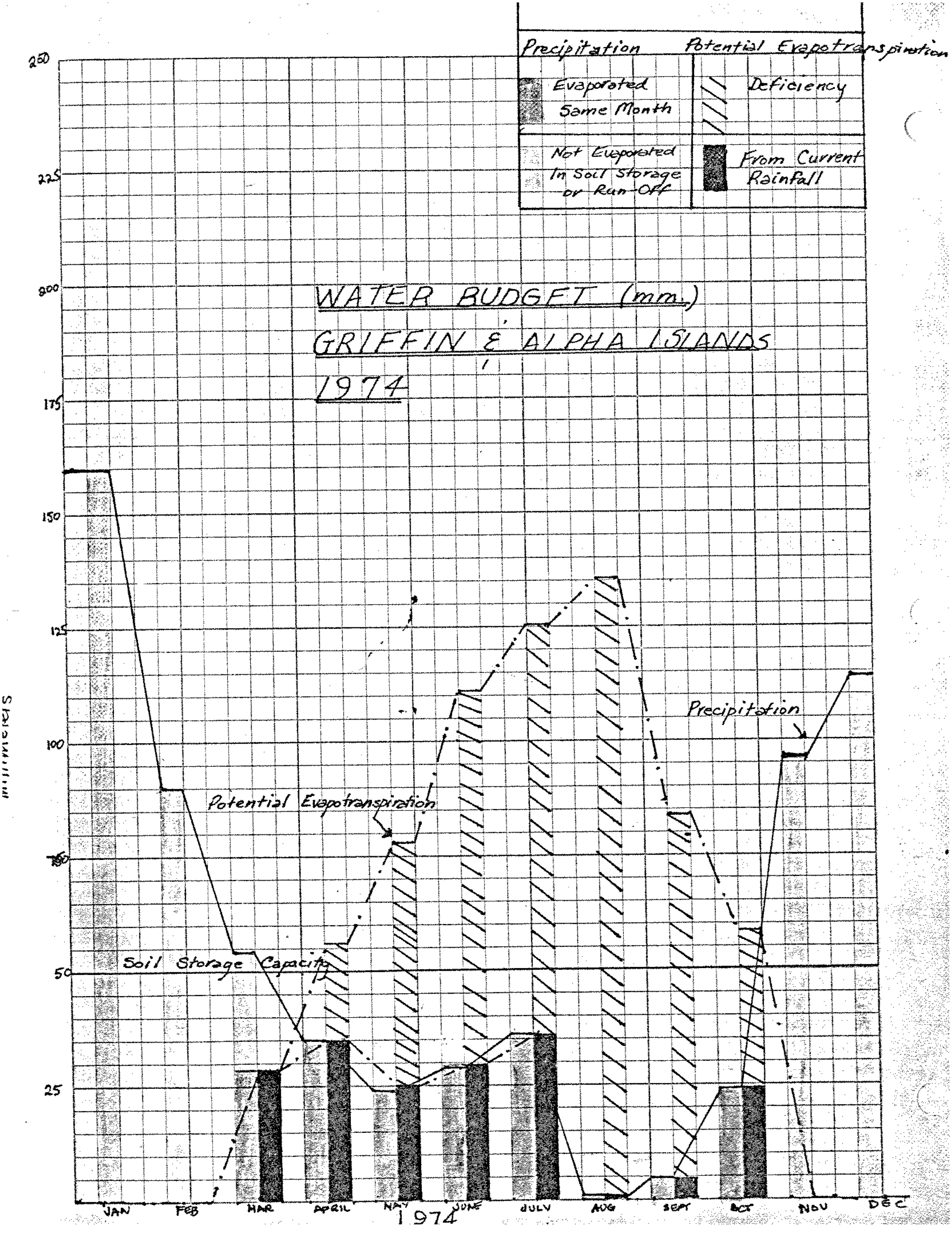
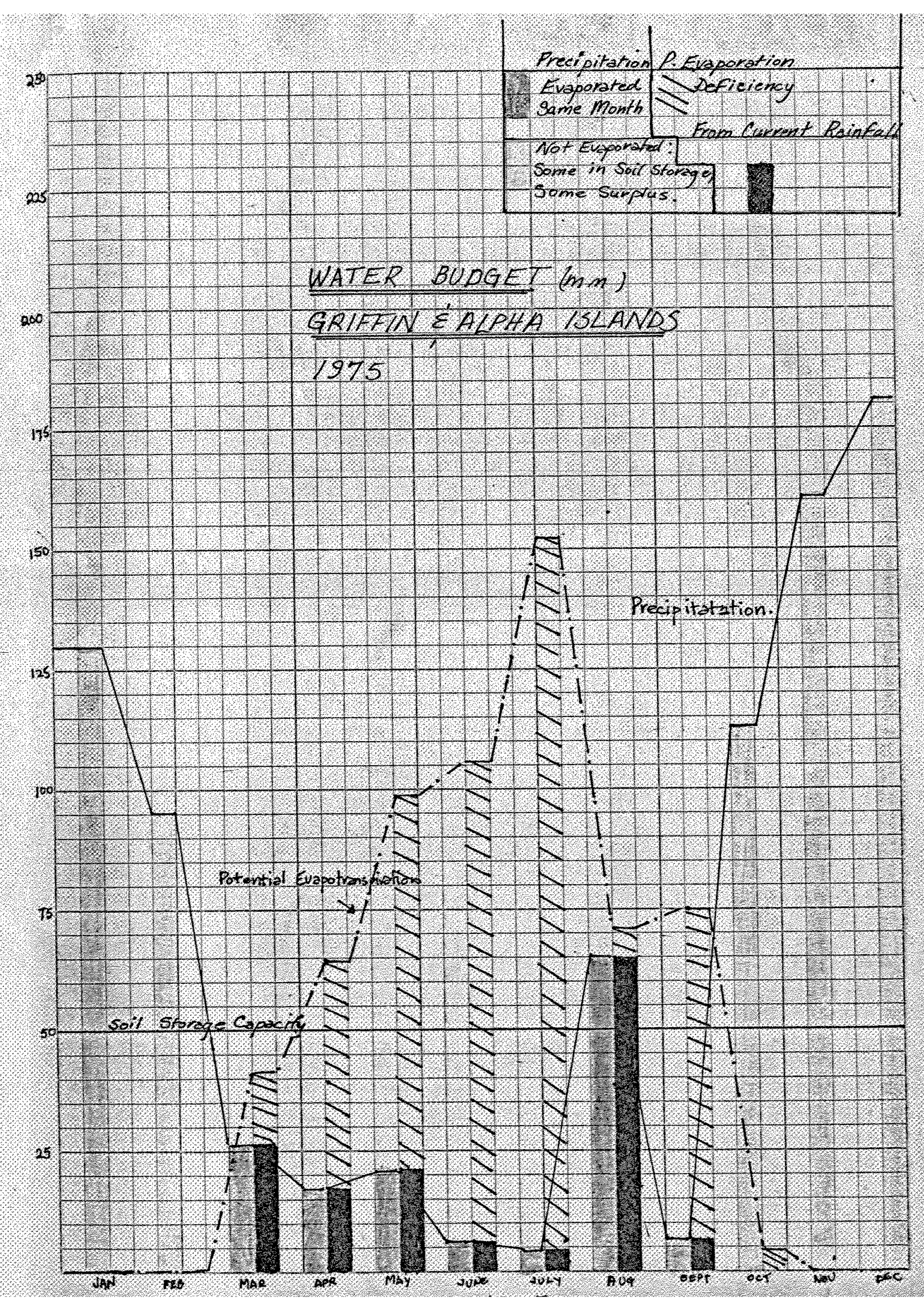
Net Deficit					29.46	81.0	94.55	129.2	73.3.	34.66		~~5~~
Soil Moisture at End of Month.	50	50	50	29.0	0	0	0	0	0	0	50	50

N.B 50 mm. was used as the soil storage capacity as. the average soils on Alpha & Griffin are not deeper than 30 cm. and and using Table 10 (Appendix) the soil storage capacity for fine (pasture) sandy loam - 150 mm / meter.


WATER BUDGET (mm.)
GRIFFIN & ALPHA ISLANDS
1974
Precipitation
Potential Evapotranspiration
Evaporated Same Month
Deficiency
Not Evaporated In Soil Storage or Run-Off
From Current Rainfall
Precipitation
Potential Evapotranspiration
Soil Storage Capacity
250
225
200
175
150
125
100
75
50
25
illimeters
JAN
FEB
MAR
APRIL
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1974



WATER BUDGET (mm)
GRIFFIN & ALPHA ISLANDS
1975

Appendix 3 Average Wind Conditions

MONTH	1974	1975	1976
January	W 20*(NE 20)	SE22 (SW15)	SW 18
Febuary	SE22 (W22)	NE 16	SE 22
March	W 20	N 16	N 15
April	W 22	SW 16	SW 18
May	W 15	SW 14	SW 12
June	W 15	SW 20	SW 12
July	W 15	SW 16	SW 11
August	SW 14	SW 16	SW 10
September	SW 15	SW 13	SW 10
October	SW 12	SE 20	NE 12
November	N 10*	SE 21	N 14
December	SE 20	N 14* (SW15)	N 15

* Note: - brackets indicate <u>second</u> greatest average (near equal)
- * indicates rainfall at least half the month
- speed given in miles per hour

Compiled by Clayton Brenton, 1977 . Discovery Island Lighthouse

APPENDIX 4

% Organic Content of Soils (Ah Layer)

a)Dried at 105°C for 24 hrs, weighed, b) then ashed at C°
for 4 hours, then weighed.

Control Soil Mini Mountain	.0167975%
Chatham Grazed Sward	.036605%
Alpha Camassia Meadow	.0457903%
Alpha Shallow Soil Aira Praecox	.046663%
Rhacometrium Soil Pocket	.039074%
Sedum Rock Halophyte	.077407%
Elymus- Lathyrus Driftwood Community	.032605%
A triplex Shingle Community	.024758%
Otter Trail	.071771%

APPENDIX 5.

PRODUCTIVITY ASSESSMENT

Dry Biomass Weight of Vegetation (including Root Material) taken from 25 cm x 25 cm plots.

Dryest at 105° C for 24 hrs.
Collected November 4, 1977.

	With Box	Without Box
3b Exposed Sedum Rock Halophyte	101.40 g	29.14 g
2b Interior Rock Outcrop (Totally Vegetated) Aira Praecox Meadow	149.72 g	77.00 g
3a Soil Pocket (Partially Vegetated)	105.37 g	33.00 g
5 Atriplex Beach Community	76.00 g	4.00 g
4b Elymus-Lathyrus Beach Community	284.80 g	216.80 g
2a Alpha Forb Camassia Meadow	147.5 g	75.50 g
2a Griffin Camassia Meadow	304.81 g	236.81 g
1b Alpha Shrub	320.26 g	248.26 g
Chatham Sward	110.78	38.78 g
Other Trampled Plot	112.28	40.28 g

Appendix 7

Wildlife Observations
Griffin & Alpha Islands between Oct 5 & Oct 23, 1977

Map reference 92 B/6 f & g
Observers Trudy Carson, Lynne Milnes

October 5th, 1977

Song sparrows	5	Alpha	Island
Black oystercatchers	2	Offshore	Alpha
Pelagic Cormorants	7	"	"
Bonaparte's Gulls	6	"	"
Glaucous-winged Gulls	2	"	"
Great Blue Heron	1	Offshore	Griffin
Bufflehead Ducks	2	"	"
Pelagic Cormorants	27	"	"
Harlequin Ducks	14	"	"

October 9th, 1977

Song Sparrow	- 2 -	Elymus on Alpha ;Griffin Meadow	
Black oystercatcher	2	Offshore	Alpha
N.W. Crow Nest	1	Griffin	Salix Community
Belted Kingfisher	1	Griffin	
Heerman's Gulls	30	Alpha	Rocks
Glaucous-winged Gull	60	"	"

October 10, 1977

Belted kingfisher	1	Griffin	Island
Greater yellowlegs	2	offshore	Alpha
Common loon	1	"	"
Black Oystercatcher	8	"	"
Tree Swallows	15	"	"
Pelagic Cormorants	4 imm.	10 Adult	
Heerman's Gulls	12		
Great Blue Heron	1.		
Harlequin Duck	3 ♀ 1 ♂		

1 Seal. — Offshore
1 Marsh Hawk – Snag on Griffi
American Robin – Griffin meadow.

Glaucous-winged Gulls	~~ca.~~ 59	Rocky Outcrop east of Alpha
Heerman's Gulls	41	" "
Common Loon	1	Offshore Alpha
Brant's Cormorant	8	" "
Pelagic Cormorant	7	" "
Black Oystercatcher	2	Shoreline Alpha
Song Sparrow	4	Shrub + Elymus - Alpha
Harlequin Ducks	3♂, 1♀	Offshore Alpha
Bewick's Wren	1	Alpha meadow
Northern sea-lion	1	Offshore Alpha.
Parasitic Jaguer	1	Chasing 15 Glaucous Winged Gulls
Mew Gull	1	Offshore Alpha
Common Murre	2	" "
Surf Scoters	2	" "
River otters	3+	Driftwood Alpha.

October 16, 1977

Glaucous-winged gulls	~60	Offshore Griffin
Harlequin duck	5	"
American widgeon	2	"
Pelagic cormorants	19	"

October 21st, 1977

Surfscoter ♀	1	Offshore Griffin
Starlings	5	Trees "
Dark-eyed junco	1	"

October 22, 1977

Hair-seal	-1	Offshore Griffin
House-finch	-8	Trees Griffin
Belted kingfisher	-2	" "
Wilson's Snipe	2	Offshore Griffin
Canada Goose Scats	-	Griffin Meadow