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Preferential Food habits of Aplodontia Rufa

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PREFERENTIAL FOOD HABITS OF *APLODONTIA RUFA*

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CHAPTER I

INTRODUCTION

Aplodontia rufa, commonly known as the mountain beaver, is a small burrowing mammal. A mature animal is approximately twelve to fourteen inches long and weighs from two-and-one-half to three pounds. The color is generally brown although some have a small white spot on the chest. A very short muzzle is made inconspicuous by the very large vibrissae protruding from it. It is thought that the vibrissae aid somehow in negotiating the darkened recesses of its tunnel systems. The eyes are very small for an animal of this size, and the ears are small and set closely to the head. The unusual size of the eyes and the positioning of the ears are probably adaptations for a subterranean existence. The head appears to be directly connected to a heavy looking body. The animal moves about on four very short legs which give it a squatty appearance. The feet, particularly the front ones, resemble hands accounting for its ability to climb small trees and shrubs. Ingles says that the mountain beaver ". . . resembles a large, overgrown pocket gopher, but it lacks the external cheek pouches and the nearly naked tail" (18:14).

The mountain beaver's range is limited to the western portion of the United States and Canada. The southern portion

of British Columbia is the northern most part of the range and San Francisco marks the southern boundary. The range is bounded on the west by the Pacific Ocean and on the east by the interior portions of the Cascade and Sierra Madre mountain ranges (17:141). The range also extends vertically from sea level to elevations exceeding four thousand feet (31:87).

The home of the mountain beaver is in a system of tunnels that are relatively close to the surface. The majority of the tunnels are covered by only a few inches of dirt, whereas, the nest and the tunnels leading to it are around two feet below the surface (27:4). The tunnels appear to have been built in random horizontal directions and generally follow the contour of the ground. The mountain beaver constructs a tunnel instead of a trail when it travels from place to place and moves about in a somewhat restricted area outside the tunnel entrance. The system of tunnels can be identified as many of the openings have rather large mounds of dirt and debris piled in front of them. Other tunnel openings have little bundles of vegetation stacked in front of them.

It is generally accepted that the animal is nocturnal, however, reports indicate it may infrequently be seen in the vicinity of the tunnels during the dim light of early morning or late evening. The mountain beaver is active in the tunnels during the day (16:387). Activity also has been reported

during all seasons of the year, even during such adverse conditions as heavy snowfall (4:555).

Economically the mountain beaver is of little value. The early fur companies purchased few pelts. To the Indian, however, the mountain beaver served as a source of food and the pelts served as articles of clothing. The animal is no longer used for food as the meat is dark and tough. Today a prime pelt is worth less than twenty cents. Some writers feel that the mountain beaver does have some economic significance in that the animal supposedly damages young trees. Further economic significance stems from the erosion caused by the system of tunnels (12:26-27).

The mountain beaver is a herbivore. It feeds on plants growing near the entrance to the tunnels. The plants it uses for food or nesting materials range from small succulent herbs to small limbs from coniferous and deciduous trees. The role it plays in reforestation programs has not been fully ascertained. Some writers feel that the mountain beaver does considerable damage while others claim the damage to young trees is insignificant (12:26). In some areas the animal can be a nuisance to people by eating cultivated plants.

The first written accounts of the mountain beaver can be found in the journal of the Lewis and Clark Expedition (12:2). Since that time, many studies have been made of the

mountain beaver, several of which contain some information on its food habits. However, it is difficult to ascertain the exact diet and preferences associated with food habits from them.

It is generally accepted that the mountain beaver is a strict herbivore feeding upon all species of plants within the vicinity of its tunnels. However, only some sixty-three species of plants are cited in the literature as being used for either food or nesting materials. It seems strange that only sixty-three species of utilized plants could be found in a range the size of the one occupied by the mountain beaver.

Bailey's study of the mountain beaver in Oregon finds that the animals are active during all seasons of the year and that it engages in some haymaking activities. He found that a lily (Vagneia sessilifolia) was its favorite. Other plants that were also favored for food were vetch, lupine, salal and ferns. He also mentioned willows, alders, maples, thimbleberry, and valerian as being used for food. He also studied the Pacific mountain beaver along the coastal region. He found the favorite food plants were salmonberry, thimbleberry, huckleberry, and ferns. Other plants mentioned as used to a considerable extent were alder, vine maple, hemlock and cedar. He also mentioned that many other plants were also eaten (2:225-228).

Cahalane states that the mountain beaver is a vegetarian and includes a wide variety of plants in its diet. Also mentioned was the discovery that the diet changes as the seasons change. He found that the mountain beaver prefers deciduous species of woody plants. The favorite deciduous species were willow, alder, hazel, dogwood, maple, elderberry, current, and gooseberry. During the summer thimbleberry, raspberry, brakefern, sword-fern, horsetail and skunk cabbage were also favored. During the winter the favorites were evergreen species such as cedar, western hemlock, Douglas fir, salal, Oregon grape, and ferns. Peculiar habits associated with food gathering during periods of heavy snowfall were also described (4:550-556).

Dalquest found that the diet consisted of leaves, bark, herbs, and roots. He also discovered that the mountain beaver was the only known animal to eat brake-fern. Other plants given as food sources were Douglas fir, red cedar, hemlock, blackberry, black-cap, devil's club, skunk cabbage, and stinging nettle. He also stated that it eats most plants in its environment and is not known to refuse any species for food (7:366-370). He mentions that it cures material and stores it for consumption during the winter months, but that they do forage during winter and feed upon evergreen shrubs. During periods of heavy snowfall the mountain beaver burrows beneath the snow in the quest of food.

Scheffer's study is concerned with the mountain beaver in the Puget Sound region. His study includes a list of plants that are eaten by the mountain beaver. He also describes twig clipping, caching, burrowing beneath the snow, and other activities associated with feeding behavior. A preference for deciduous species of trees and shrubs was discovered. He discovered that the animal eats thirty-two species of plants. He observed that, "The mountain beaver uses either for food or nesting materials almost any green thing that grows in its habitat" (27:5).

Godin compiled a bibliography of works pertaining to the mountain beaver and in addition, summarized the findings. He has this to say about the current status of the work pertaining to the mountain beaver:

> . . . there is a dearth of knowledge regarding its ecology. We need to know more about its adaptation to new environments, direct effects on man's activities, depredation, food habit studies, predatory relationships, movements (immigration and emigration), population dynamics, methods of inventory and carrying capacity to mention a few (12:29).

The geographical extremes associated with the mountain beaver range are responsible for a variety of climates (18:141). The climate of the rain forests of Western Washington differs from the climate of cold temperatures, and heavy snows of the Cascade Mountain areas such as found in Mt. Rainier National Park. The northern portions of the mountain beaver's range in British Columbia have a different

climate than that associated with the southern portion of the range near San Francisco. The different climatic conditions prohibit a uniformity in the vegetation types throughout the range. This lack of uniformity of vegetation types becomes apparent in a review of the literature. Plants cited as being eaten or available in one portion of the range are missing entirely or mentioned only infrequently in lists from other portions of the range. This condition makes it extremely difficult to single out a list of plants eaten by the mountain beaver that will apply to all parts of the range. In addition, a list of preferential foods will also be applicable to the range as a whole but not to a specific portion therein. It is possible, however, to divide the range and prepare lists of plants eaten and preferential plants for small areas where a more homogeneous vegetation type occurs. It is the purpose of this study to determine the preferential food habits of the mountain beaver (Aplodontia rufa) on some nine hundred acres of logged over land located in sections 3, 4, 9, 10, and 12; Township 14, Range 4, West Willamette Meridian, Lewis County in Washington State. Limiting the problem to such an area will allow for the determination of food habits. This study then will be applicable only in areas similar to the one studied, not for the range as a whole.

CHAPTER II

METHODS AND MATERIALS

It was necessary to determine what plant species were available and the relative availability of each. In addition, a means of determining what species were eaten and the relative amount consumed was also necessary. The comparison of the two would indicate if a preference for certain species existed and if the preferences were predicated upon availability.

The canopy coverage method was used to make the vegetation analysis (9:43-61). Three macroplots were marked out in each division. A macroplot measured twenty-five meters by fifteen meters. The macroplot was divided into three equal plots having a length of twenty-five meters and a width of five meters. Along the interior twenty-five meter lengths of the two outer plots a series of microplots were measured out. The microplots having a length of fifty centimeters and width of fifteen centimeters. The actual frequency and coverage of plants under one meter in height was taken from the microplots. Shrubs, trees, and seedlings over one meter in height were counted on the macroplots associated with the canopy-coverage method.

The study area had three visually distinct groupings of plants dominated either by brake-fern, sword-fern, or

salal. A vegetation analysis was made which illustrated the dominance of these three species. In addition, the analysis revealed what plants were associated with the above dominant species and the uniformity of the community. The areas characterized by these three plants are referred to in the remainder of the paper as Brake-Fern Division, Sword-Fern Division, and Salal Division. Three separate study plots were marked out in each division and were analyzed (Tables 1, 3, 5). Clipping activities of the mountain beaver were one of the means utilized to determine which species were being eaten or used for some other purpose. Clipping activities were readily apparent on trees, shrubs, ferns, and other woody species. The evidence, particularly on trees and shrubs, was accumulative and several years of clipping activities were observable. Recent clipping activities could readily be distinguished from old clippings.

The clipping activities could be identified as belonging to the mountain beaver by the characteristic oblique cut which ruled out all other animals except rodents. The size of the plants eliminated all rodents with the exception of the rabbit (Lepus americanus). The relative scarcity of this rodent in the study area, along with the near proximity of mountain beaver tunnels and the height of the cuttings on the trees and shrubs, for the most part, ruled out the rabbit.

Both animals make the oblique sloping cut characteristic of rodents, however, rabbits usually cut stems smaller than one-quarter inch in diameter and relatively close to the ground whereas the mountain beaver will cut larger stems and clip up to heights exceeding ten feet (22:19).

This method entailed basically the noting of which plants had been clipped and the relative amount of clipping.

A major portion of the data for the study of food habits came from the observation of caches. Caches were found near the entrances of the tunnels.

> By noting critically the signs of its feeding on herbaceous plants and shrubs and by sorting over the food cached temporarily at burrow entrances, one may get first-hand knowledge of the diet. . . . (27:5)

The debris heaps found at the terminus of some tunnels also offered evidence of plants utilized either for food or nesting (27:6). The debris heaps were sorted and sifted to find portions of the plants. Sorting and sifting was applicable only to those plants resistant to decay.

Stomach analysis of trapped mountain beaver was also used in determining food habits. A microscopic examination of stomach contents was employed (10:3) since plant identification by macroscopic examination of stomach contents was unsuccessful.

A series of slides of the epidermal surfaces of the leaves of each species found in the study area was made. The

epidermal surfaces were peeled off and the peel was then given a series of alcohol baths prior to mounting in balsam. Other slides depicting structural oddities were also used as a means of identification: for example, the astrosclerides found in Douglas fir, spores of ferns, etc. These slides were to be used in identifying the ingested plants found in mountain beaver stomachs. A small portion of the stomach contents was placed on a glass slide. A drop of ten per cent alcohol solution was added, and a cover slip was placed over the slide. A significant portion of the ingested plants had been broken down so that the epidermis was free along with such things as spores, seeds, etc. On several occasions the condition of the ingested plants was such that the epidermal surface had to be teased free from the remains of the leaf. A comparison of the slides with the permanent slides was made.

Grass was easily recognizable as grass, but the species could not be identified. Consequently, grass was identified only as grass.

The field work associated with the study comprised a span of seventeen months. During the entire seventeen months caches, debris heaps, and clipping activities were observed. During twelve of the seventeen months mountain beaver were trapped for the stomach analysis. During five of the seventeen months vegetational analysis was undertaken.

CHAPTER III

RESULTS

The results of the vegetation analysis and the findings concerning food habits are given separately for each of the three vegetation divisions. This will aid the reader in comparing the vegetation analysis with the food habits of the mountain beaver in each of the three divisions. Plants will be referred to be common name; the scientific names can be found in the complete plant list table on page 44.

Brake-fern Division

In the brake-fern division fifty-seven species of plants were identified. Those plants having the higher frequency (the average number of times it occurs during the analysis) and coverage (the average amount of ground covered by the vegetation) were, in descending order: brake-fern, trailing blackberry, Sierra Nevada pea, tansy, velvet grass, fireweed, pearly everlasting, and ox-eyed daisy. Many other plants under one meter in height were also present but were less common than those mentioned. The trees, for the most part, were small, the majority being Douglas fir and red alder. A few widely scattered clumps of broad-leaf maple help to characterize this division. The frequency of Douglas fir seedlings was highly variable. Shrubs were widely scattered. Among the more common were vine maple, blue elderberry, and red huckleberry.

Many species of plants were found in the caches. A greater variety occurred during the spring and summer. Salal and Oregon grape occurred regularly in the caches the entire year. When brake-fern was available, it occurred in the caches regularly. The regularity of occurrence and the bulk of the material in the cache made up by each of these three species far exceeded that of any other. Other plants found with some degree of regularity were Sierra Nevada pea, trailing blackberry, Douglas fir, alder, tansy, ox-eyed daisy, pearly everlasting, and fireweed. See Table I, page 14.

During the months of May and June, the frequency of occurrence of Douglas fir, alder, and vine maple in the caches in the brake-fern division. The Douglas fir seemed to be utilized the rest of the year on a reduced scale whereas alder and vine maple were used only during the spring and summer months.

The variety of plant species was very limited during the winter. Salal or Oregon grape made up most of the material found in the caches during this period. Trailing blackberry was often found mixed in with the Oregon grape and salal as was sword-fern, whenever it was available.

The findings in the debris heaps were limited by the ability of a plant species to resist decay in the tunnels. In general, only the woody plants could be identified. During the spring and summer months the debris heaps commonly

TABLE I

AVAILABILITY OF PLANTS - BRAKE-FERN DIVISION

alder	p	purple pea	D
annual brome	D	red flowering current	p
blueberry elder	p	red huckleberry	p
brake-fern	D	salal	p
broad-leaf maple	p	self heal	p
Canada thistle	p	Siberian miners' lettuce	p
cherry	P	star flower	p
crow's foot	p	stinging nettles	p
Douglas fir	P	sword-fern	p
English plantain	p	tansy	D
fire weed	D	thimble berry	P
fox glove	p	trailing blackberry	D
galium	p	trailing yellow violet	P
hairy cat's ears	P	trillium	p
hazel	P	twisted stalk	P
Henderson's sedge	p	Vancouveria	P
Indian thistle	p	velvet grass	D
lily-of-the-valley	P	vine maple	P
lotus spp.	p	white clover	p
ocean spray	p	wild ginger	P
Oregon grape	P	wild rose	p
osmorhiza	p	willow	p
ox-eyed daisy	D	wood rush	p
pearly everlasting	D		

D = dominant, P = plentiful, p = present

contained the remains of brake-fern. Following closely in occurrence during this period were Oregon grape, salal, and trailing blackberry. Occasionally the remains of Sierra Nevada pea, Douglas fir, and alder were found. During the winter the debris heaps contain salal, Oregon grape, and trailing blackberry.

The evidence of clipping was mainly found on woody plant species. Those woody plants evidencing the most clipping were Douglas fir, alder, vine maple, huckleberry, western hazel, and bitter cherry. Other plants infrequently clipped were gooseberry, willow, grand fir, red flowering current, wild rose, and western hemlock. Broad-leaf maples occurred frequently and had many succulent shoots at their base; however, no evidence of clipping on broad-leaf maples could be found.

The stomach contents of nineteen mountain beaver were analyzed. The animals were trapped so that there would be representatives from the four seasons of the year. Only nine species of plants were identified during stomach analysis. The quantity of an ingested species was determined by the frequency of its occurrence during identification. Also discovered were sword-fern, salal, brake-fern, trailing blackberry, ox-eyed daisy, alder, Douglas fir, honeysuckle, and grass.

During the spring and summer months brake-fern was found more often and in greater proportion in the stomachs than any other species. Trailing blackberry occurred in five of the eleven stomachs representing these months. In one stomach it was the only species identified. Other plants found in the stomachs were ox-eyed daisy, alder, Douglas fir, honeysuckle, and grass.

The examination of stomachs representing the winter months indicated a shift in diet. All eight of the stomachs contained sword-fern. Five of the nine stomachs contained only sword-fern. Alder, salal, and grass were also found but each occurred only once.

The results from the food habit studies in this division indicated that a definite shift in food habits occurred at the beginning and end of the growing season. A greater variety in diet was apparent during the spring and summer. However, the bulk of the food during the entire year was made up of salal and Oregon grape. During the growing season, brake-fern was used as much or more than salal and Oregon grape. It was also found that trailing blackberry was used throughout the year in significant quantity. Other plants making up a significant portion of the diet during the growing season were Sierra Nevada pea, Douglas fir, alder, tansy, ox-eyed daisy, pearly everlasting, and fire weed. The usage of Douglas fir and alder was accelerated during the months of May and June.

TABLE II

STOMACH ANALYSIS - BRAKE-FERN DIVISION

Month	2	2	2	4	4	5	5	6	6	7	7	9	10	10	11	11	11	12	12
Day	6	6	28	11	11	11	15	12	29	3	10	27	1	8	5	11	24	20	20
sword-fern	X	X	X												X	X	X	X	X
salal			X	X															
brake-fern					X	X		X	X	X	X	X	X						
trailing blackberry							X	X	X			X		X					
ox-eyed daisy								X					X						
alder													X						
Douglas fir															X				
honeysuckle																			
grass				X							X						X		
brome seed				X															
unknown seed				X				X											
wood														X					
brake-fern root													X						
rock												X							

Stripping of bark from trees and shrubs was discovered during and immediately after heavy snowfall. No evidence of stripping by mountain beaver could be found on bitter cherry, however, broad-leaf maple, vine maple, hazel, and Douglas fir bore considerable evidence of stripping.

Salal Division

The vegetation analysis in the salal division resulted in the identification of forty-five species of plants. This division was visually identified by the dense cover of salal. Other abundant species in descending order of frequency and coverage were brake-fern, Oregon grape, trailing blackberry, and Sierra Nevada pea. Many other small herbaceous plants were in evidence but not as common as those mentioned. The overstory was not constant; it either formed a dense canopy or was made up of widely scattered trees. The most common trees were Douglas fir, alder, and broad-leaf maple. See Table III, page 19.

Some twenty-four species of plants were found in the caches during an eighteen month period. Salal and Oregon grape were present in almost every cache, making up the bulk of the plant matter in the cache. Trailing blackberry also was found with regularity throughout the year. Sword-fern occurred in the caches whenever it was available.

TABLE III

AVAILABILITY OF PLANTS - SALAL DIVISION

alder	D	ox-eyed daisy	p
annual brome	D	pearly everlasting	P
brake-fern	D	polypody	p
broad-leaf maple	D	purple pea	D
cherry	P	red huckleberry	P
circea	p	salal	D
columbine	p	starflower	P
common horsetail	P	stellaria	p
crow's foot	p	sword-fern	p
Douglas fir	P	thimble berry	P
fire weed	P	trailing blackberry	D
hairy cat's ears	p	trailing yellow violet	p
hazel	P	trillium	p
Henderson's sedge	p	twisted stalk	p
Indian plum	p	velvet grass	p
nemophilia	p	vine maple	P
ocean spray	p	wild ginger	p
orchard grass	P	willow	p
Oregon grape	D		

D = dominant, P = plentiful, p = present

Those plants showing the highest degree of clipping activity were alder, Douglas fir, and vine maple. Salal and Oregon grape clipping was also evident. It was difficult to assess the clipping activities on these two species as the characteristic angular cut was not as evident. In addition their frequency and coverage was so great that it was difficult to find the clipped stems.

Debris heaps in the winter contained salal and Oregon grape remains with some trailing blackberry. During the growing season brake-fern commonly occurred in association with trailing blackberry and Oregon grape. Occasionally the remains of Sierra Nevada pea was found during the early summer months.

Twenty-five animals were trapped in the salal division. An analysis of their stomach contents revealed the ingestion of eight species of plants. See Table IV, page 21. Of the twenty-five stomachs examined, salal was found in every stomach except one. Brake-fern and sword-fern were found in seven stomachs; however, they never occurred together. In each case of occurrence sword-fern or brake-fern was found to occur only during the growing season, whereas, sword-fern was found to occur in all seasons. Oregon grape was found in three stomachs. The remaining plants identified by stomach analysis were found to occur just once, and they made up only a small portion of the bulk. There was one exception in which

TABLE IV

STOMACH ANALYSIS - SALAL DIVISION

Month	1	1	1	1	2	2	3	3	4	4	4	5	5	6	6	7	7	7	7	7	10	10	11	12	12
Day	31	31	31	31	21	21	13	30	17	17	17	16	23	29	29	4	12	23	26	28	8	17	1	8	8
salal	X	X	X	X	X	X		X							X	X		X			X	X	X		X
Oregon grape							X					X										X			
brake-fern									X	X	X					X	X		X		X				
sword-fern							X						X	X	X			X		X		X	X		
alder														X											
vine maple																						X			
trailing blackberry															X									X	
grass									X																
grass seed																									
unknown					X											X									
rotten wood																	X								

trailing blackberry made up the entire content of the ingested material.

The combined data on food habits in the salal division shows that brake-fern, salal, and Oregon grape were the most frequently occurring species. In addition, they provided the greater portion of the bulk of the plant matter. During the growing season brake-fern, salal, and Oregon grape were used in that order. During the remainder of the year salal and Oregon grape had the highest frequency and quantity of use. Salal had the highest frequency and quantity of use over the span of one year. Other plants used with some degree of frequency were Sierra Nevada pea, trailing blackberry, Douglas fir, alder, and sword-fern. Sword-fern and trailing blackberry were utilized during the entire year. Sword-fern was used extensively where ever it was available. A shift of food habits was noted during the growing season toward a selection of a greater variety of plants.

Sword-fern Division

Fifty-two species of plants were found in the sword-fern division. This division was identifiable by the dense cover of sword-fern. Other species occurring in this division to a lesser degree were Oregon grape, small flowered nemophilia, Oregon bedstraw, Siberian miner's lettuce, trailing blackberry, slender stemmed water leaf, and brake-fern. The canopy was formed by a mixed forest of broad

leaf deciduous trees and needle-leaved trees. Alder was the most frequently occurring broad leaf species. The presence of broad-leaf maple was also significant. Douglas fir was the most frequent evergreen tree. Hemlock and bitter cherry were scattered throughout the forest. See Table V, page 24.

Over the course of the study twenty species of plants were found in the caches. A wider variety of species were found in the caches during the growing season as opposed to a narrower selection during the remainder of the year. Sword-fern was the one species found most often in the caches and making up almost the entire bulk of these caches. Its occurrence was so great that one could predict with amazing accuracy that the next cache found would contain sword-fern. Over the course of the study and the consequent accumulation of data, salal, trailing blackberry, and Oregon grape were found to be used frequently as food sources. It was noted again that the occurrence of shrubs and trees was higher during May and June than for any other months. Alder was the most frequently occurring tree followed by vine maple.

The evidence of clipping in this division was considerably reduced over that of the other two divisions. Clipping was apparent on sword-fern, alder, vine maple, Douglas fir, and huckleberry. A Douglas fir having a diameter of two inches at breast height was discovered lying on the ground. The roots had been clipped off as had been most of

TABLE V

AVAILABILITY OF PLANTS - SWORD-FERN DIVISION

alder	D	polypody	p
annual brome	p	Purple pea	p
bedstraw	D	red flowering current	P
bleeding heart	p	red huckleberry	p
blueberry elder	p	salal	p
brake-fern	D	Siberian miner's lettuce	D
broad-leaf maple	D	slender stemmed waterleaf	D
bunchberry	p	smooth fairy bells	P
cherry	P	stelleria	p
circea	D	sword-fern	D
Douglas fir	P	thimble berry	p
Fendler's meadow rue	p	trailing blackberry	D
fox glove	p	trillium	p
hazel	P	twisted stalk	p
hemlock	p	Vancouveria	p
Henderson's sedge	p	vanilla leaf	p
large fringe cup	p	velvet grass	P
lily-of-the-valley	p	vine maple	D
maidenhair-fern	p	western sweet cicily	P
mountain dentaria	p	wild ginger	p
nemophilia	D	wild rose	p
Oregon grape	D	willow	p
osmorhiza	p		

D = dominant, P = plentiful, p = present

the limbs. Considerable stripping of the bark had also taken place. In all likelihood the clipping of the roots caused the sapling to fall since it was protected from the wind. Douglas fir was not a major food source in this division as it was relatively scarce. It was used as a food source, however, when it occurred.

Most of the animals in this division were taken during the growing season; however, there were representatives of each season. Only eight species of plants were discovered after analyzing twenty-two stomachs. Every stomach contained sword-fern and it made up the greater part of the bulk of the ingested material in nineteen of the stomachs. In two of the stomachs sword-fern made up half of the contents and salal the other half. In another stomach, Oregon grape made up half the contents and sword-fern made up the rest. Other species of plants found in the stomachs were trailing blackberry, mountain denteria, Sierra Nevada pea, alder, and grass. In two stomachs rocks were found mixed with the ingested materials. An aphid was found in another stomach. Two other stomachs contained some unidentifiable plant species. See Table VI, page 26.

Sword-fern was used more extensively both in occurrence and quantity than all other species combined during the entire year. Salal, Oregon grape, and trailing blackberry were the next most frequently occurring species. Of the trees and

TABLE VI

STOMACH ANALYSIS - SWORD-FERN DIVISION

Month	1	3	3	3	4	4	4	5	5	5	5	5	5	5	7	7	7	7	7	7	9
Day	22	6	6	6	4	11	12	4	4	4	4	14	15	15	20	5	10	12	20	28	28	27
sword-fern	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
trailing blackberry							X	X					X									
mountain dentaria							X															
purple pea								X														
salal										X			X									
alder											X					X						
Oregon grape												X										
grass		X							X	X									X			
seed																						
rotten wood																	X					
unknown													X				X					
rock														X			X					
insect							X															

shrubs, alder and vine maple had the higher frequency of occurrence. It was also noted that stripping occurred during a period of heavy snowfall. The trees receiving the most stripping were broad-leaf maple, vine maple, and Douglas fir.

When the food habit data was combined from the three divisions, it was apparent that four species were used more extensively than the other species of available plants. Those highly used species were sword-fern, brake-fern, salal, and Oregon grape. Even when these plants were not as common as other species, they were still used to a higher degree. Other plants having a high degree of utilization were trailing blackberry, alder, vine maple, Douglas fir and Sierra Nevada pea. About half of the plants available were used as a source of food. It was also noted that a greater variety of plants were used during the growing season, that clipping of alder and Douglas fir occurred more often during May and June, and that stripping of bark occurred during snowfall.

CHAPTER IV

SUMMARY AND CONCLUSIONS

The final analysis of the vegetation study indicated a distinct difference in the three divisions. Some species of plants were found to be unique to one division while the frequency and coverage of species common to two or three divisions varied greatly from division to division. The vegetation study indicated that the frequency and coverage of a given species was fairly uniform throughout a particular division. Such a breakdown of the vegetation made it possible to have a more precise knowledge of what plant species were available and the relative availability of each. Information of this type made it possible to be more specific in determining the selective utilization of preferred species.

The data compiled from the various aspects of the food habit study revealed that the plant species used to characterize a division were the species most often selected for food by the mountain beaver. The only deviation from this was in the brake-fern division. Brake-fern was not available during the winter and was replaced as the preferred food in the brake-fern division by salal and Oregon grape; however, when brake-fern was available it was the preferred species in its division. Additional data revealed that sword-fern, brake-fern, and salal were also preferred in the divisions

where they were not the species having the highest frequency and coverage; for example, in the salal division where salal was the preferred species, sword-fern and brake-fern were used quite extensively. The use of sword-fern and brake-fern in the salal division often exceeded the use of other plant species having a greater frequency and coverage. The selection of salal, sword-fern, and brake-fern as a preferred species by the mountain beaver depends upon their relative availability with respect to one another. The data also revealed that sword-fern was more preferred in its division than salal and brake-fern were in their respective divisions.

Two other species being used quite extensively by the mountain beaver were Oregon grape and trailing blackberry. The preference for Oregon grape in the salal division was very high, exceeding even that of brake-fern and sword-fern. Oregon grape was more abundant than brake-fern and sword-fern in the salal division. Trailing blackberry was used quite extensively in all three divisions and was also fairly common. Oregon grape was preferred over trailing blackberry in the salal division, but not when the three divisions were considered as a whole. The selection of these two species as to which was the more preferred was based on availability. Trailing blackberry was more preferred when all three divisions were taken into consideration but Oregon grape had the higher

preference where its abundance or availability approached that of trailing blackberry.

Other plants used to a lesser degree than those mentioned were Sierra Nevada pea, ox-eyed daisy, alder, vine maple, Douglas fir, pearly everlasting, and fireweed. A rating of these species as to order of preference could not be made. A preference was discovered here in relation to alder, vine maple, and Douglas fir. The data revealed that during the growing season vine maple, alder, and Douglas fir were selected more often during the months of May and June. It was beyond the scope of this study to ascertain why the selection was greater during May and June, but it possibly could be due to the growth of succulent shoots during this period. Alder and vine maple limbs were not cut after the leaves had fallen in the autumn, however, Douglas fir was used all year. Other species of plants in addition to those mentioned were also selected by the mountain beaver, but the selection of these species was so sporadic that no attempt will be made to discuss them. A list of all plant species selected as food for the mountain beaver is given along with the total species available in the appendix.

During the period of study a rather heavy (14 inches) snowfall occurred. When the snow melted, small shallow depressions in the soil could be seen radiating out from the mountain beaver tunnel entrances. Apparently, as had been

described in the literature (27:12), the mountain beaver had tunneled under the snow in search of food. These depressions frequently terminated at a clump of sword-fern or some other food source. Pictures of this can be seen on page 42 of the appendix.

Stripping of bark from trees was evident after the melting of the snow cover. Stripping of bark by the mountain beaver also had been mentioned in the literature. Stripping was not found at any other period during the course of the study. In all probability, stripping was done out of necessity rather than preference. A preference was apparent, however, in what trees or shrubs were stripped. Most of the stripping appeared to be on broad-leaf maple, vine maple, and Douglas fir. It was also noted that evidence of clipping could be found on bitter cherry during the summer, but no stripping was ever evidenced. The reverse was true for broad-leaf maple.

Evidence of climbing small trees and shrubs by the mountain beaver was apparent in the study area. On some alders, the mountain beaver climbed to heights of twelve feet. The climbing was done in connection with clipping activities. Small trees with the stubs of limbs projecting from them could be found in a number of places. Pictures of these trees can be found on page 39 of the appendix.

In summary, the findings of this study are that the mountain beaver does exhibit preferences in his food habits. It selects for food just less than one-half of the available plant species. Three species are preferred over all others selected for food, those species being sword-fern, salal, and brake-fern. A rather strong preference is exhibited for trailing blackberry and Oregon grape. Preferences also are exhibited for Sierra Nevada pea, alder, vine maple, fireweed, pearly everlasting, and ox-eyed daisy although to a much lesser extent than those already mentioned. Preferences are also exhibited for certain species of trees and shrubs through clipping and stripping activities. At the conclusion of the study it was found that the findings as to preference matched that of Godin's (12:15) list of preferred species very closely.

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APPENDIX A

COLLECTION OF PHOTOGRAPHS

THREE PLANT DIVISIONS

(top) brake-fern division

(left) writer and salal division

sword-fern division

MOUNTAIN BEAVER CLIPPING ON TREES

pictures on left of page depict terminal clipping of Douglas fir

bottom pictures show the results of terminal clipping of Douglas fir

(top left) lateral shoot clipping of Douglas fir

(bottom left) death of an alder resulting from terminal and lateral clipping

(bottom right) terminal clipping of an alder

lateral and terminal clipping of alder

terminal clipping of vine maple

MOUNTAIN BEAVER STRIPPING

stripping of young Douglas fir

EVIDENCE OF BURROWING AND FEEDING ACTIVITIES
UNDER HEAVY SNOWFALL

APPENDIX B

COMPLETE PLANT LIST BY DIVISION

BRAKE-FERN DIVISION

Scientific Name	Common Name	Utilized
Abies grandis	Grand Fir	X
Acer circinatum	Vine Maple	X
Acer macrophyllum	Broad-leaf Maple	
Alnus oregona	Red Alder	X
Anaphalis margaritacea	Pearly Everlasting	X
Aquilegia formosa	Western Columbine	
Asarum caudatum	Western Wild Ginger	X
Bromus carinatus	California Brome Grass	X
Campanula Scouleri	Scouler's Campanula	
Carex Hendersonii	Henderson's Sedge	X
Chrysanthemum Leucanthemum	Ox-eyed Daisy	
Cirsium arvense	Canadian Thistle	
Cirsium brevistylum	Indian Thistle	
Cornus Nuttallii	Western Flowering Dogwood	
Corylus Cornuta	Western Hazel	
Dactylis glomerata	Orchard Grass	
Digitalis purpurea	Foxglove	
Epilobium angustifolium	Fireweed	X
Fragaria spp.	Wild Strawberry	
Galium spp.	Galium	
Gaultheria Shallon	Salal	X
Holcus lanatus	Velvet Grass	
Holodiscus discolor	Ocean Spray	X
Hypochaeris radicata	Hairy Cat's-ears	X
Lathyrus nevadensis	Sierra Nevada Pea	X
Lonicera hispidula	Hairy Honeysuckle	X
Lotus spp.	Lotus	
Mahonia aquifolium	Oregon Grape	X
Maianthemum bifolium	False Lily-of-the-Valley	
Osmorhiza chilensis	Western Sweet Cicely	
Plantago lanceolata	English Plantain	
Polystichum munitum	Western Sword-fern	X
Populus trichocarpa	Black Cottonwood	
Prunella vulgaris	Heal-all	X
Prunus emarginata	Bitter Cherry	X
Pseudotsuga Menziesii	Douglas fir	X
Pteridium aquilinum	Western Brake-fern	X
Ranunculus uncinatus	Little Buttercup	
Rhamnus Purshiana	Cascara	
Ribes divaricatum	Common Gooseberry	
Ribes sanguineum	Red-flowering Current	
Rosa spp.	Wild Rose	X
Rubus macropetalus	Trailing Blackberry	X
Rubus parviflorus	Thimble Berry	X

Scientific Name	Common Name	Utilized
Salix spp.	Willow	X
Sambucus glauca	Blue Elderberry	
Streptopus amplexifolius	Larger Twisted-stalk	
Tanacetum vulgare	Tansy	X
Thuja plicata	Western Red Cedar	
Trientalis latifolia	Broad-leaved Star-flower	
Trifolium hybridum	Alsike Clover	
Trifolium repens	White Clover	X
Trillium ovatum	Western Trillium	
Tsuga heterophylla	Western Hemlock	
Urtica gracilis	Northwest Nettle	X
Vaccinium parvifolium	Red Huckleberry	X
Viola sempervirens	Evergreen Violet	

SALAL DIVISION

Abies grandis	Grand Fir	X
Acer circinatum	Vine Maple	X
Acer macrophyllum	Broad-leaf Maple	X
Alnus oregona	Red Alder	X
Anaphalis margaritacea	Pearly Everlasting	X
Aquilegia formosa	Western Columbine	
Asarum caudatum	Western Wild Ginger	
Bromus carinatus	California Brome Grass	X
Carex Hendersonii	Henderson's Sedge	X
Chrysanthemum Leucanthemum	Ox-eyed Daisy	X
Circaea alpine	Smaller Enchanter's Night-shade	
Cirsium arvense	Canadian Thistle	
Cirsium brevistylum	Indian Thistle	
Cornus Nuttallii	Western Flowering Dogwood	
Corylus Cornuta	Western Hazel	X
Dactylis glomerata	Orchard-grass	
Epilobium angustifolium	Fire-weed	X
Equisetum arvense	Common Horsetail	X
Galium spp.	Galium	
Gaultheria Shallon	Salal	X
Holcus lanatus	Velvet Grass	X
Holodiscus discolor	Ocean Spray	
Hypochaeris radicata	Hairy Cat's-ears	X
Lathyrus nevadensis	Sierra Nevada Pea	X
Mahonia aquifolium	Oregon Grape	X
Nemophila parviflora	Small-flowered Nemophila	
Osmaronia cerasiformis	Indian Plum	
Polypody spp.	Polypody	

Scientific Name	Common Name	Utilized
Polystichum munitum	Western Sword-fern	X
Pseudotsuga Menziesii	Douglas Fir	X
Pteridium aquilinum	Western Brake-fern	X
Ranunculus uncinatus	Little Buttercup	
Ribes divaricatum	Common Gooseberry	
Ribes sanguineum	Red-flowering Current	
Rosa spp.	Wild Rose	
Rubus macropetalus	Trailing Blackberry	X
Rubus parviflorus	Thimble Berry	X
Salix spp.	Willow	
Stellaria crispa	Crisped Starwort	
Streptopus amplexifolius	Larger Twisted-stalk	X
Symphocarpas albus	Snowberry	X
Thalictrum Fendleri	Fendler's Meadow-rue	X
Trientalis latifolia	Broad-leaved Star-flower	
Trifolium hybridium	Alsike Clover	
Trifolium repens	White Clover	

SWORD-FERN DIVISION

Acer circinatum	Vine Maple	X
Acer macrophyllum	Broad-leaf Maple	X
Achlys triphylla	Vanilla-leaf	
Adiantum pedatum	Western Maidenhair-fern	X
Alnus oregona	Red Alder	X
Aquilegia formosa	Western Columbine	
Asarum caudatum	Western Wild Ginger	X
Bromus carinatus	California Brome Grass	X
Carex Hendersonii	Henderson's Sedge	
Circaea alpina	Smaller Enchanter's Night-shade	
Circium arvense	Canada Thistle	
Claytonia sibirica	Siberian Miner's Lettuce	X
Cornus canadensis	Dwarf Dogwood	X
Cornus Nuttallii	Western Flowering Dogwood	
Corylus Cornuta	Western Hazel	X
Dentaria macrocarpa	Mountain Dentaria	X
Dicentra formosa	Western Bleeding-heart	
Digitalis purpurea	Foxglove	
Disporum oreganum	Oregon Fairy Bells	X
Gaultheria Shallon	Salal	X
Holcus lanatus	Velvet Grass	X
Hydrophyllum tenuipes	Slender-stemmed Waterleaf	
Lathyrus nevadensis	Sierra Nevada Pea	X
Lysichitum americum	Skunk Cabbage	

Scientific Name	Common Name	Utilized
Mahonia Aquafolium	Oregon Grape	X
Maianthemum bifolium	False Lily-of-the-Valley	X
Nemophila parviflora	Small-flowered Nemophila	
Oplopanax horridum	Devil's Club	
Osmorhiza chilensis	Western Sweet Cicely	
Polypody spp.	Polypody	
Polystichum munitum	Western Sword-fern	X
Populus trichocarpa	Black Cottonwood	
Prunus emarginata	Bitter Cherry	X
Pseudotsuga Menziesii	Douglas Fir	X
Pteridium aquilinum	Western Brake-fern	X
Ranunculus spp.	Buttercup	
Ranunculus uncinatus	Little Buttercup	
Rhamnus Purshiana	Cascara	
Rubus macropetalus	Trailing Blackberry	X
Sambucus callicarpa	Red Elderberry	
Sambucus glauca	Blue Elderberry	
Stellaria crispa	Crisped Starwort	
Streptopus amplexifolius	Larger Twisted-stalk	
Tellima grandiflora	Large Fringe-cup	
Thalictrum Fendleri	Fendler's Meadow-rue	
Thuja plicata	Western Red Cedar	
Trillium ovatum	Western Trillium	
Tsuga heterophylla	Western Hemlock	
Urtica gracillis	Northwest Nettle	X
Vaccinium parvifolium	Red Huckleberry	X
Vancouveria hexandra	Inside-out Flower	
Viola sempervirens	Evergreen Violet	

APPENDIX C

DATA FROM PLANT ANALYSIS BY CANOPY COVERAGE METHOD AND DENSITY OF TREES BY SIZE CLASSES BY DIVISION

BRAKE-FERN DIVISION
DATA FROM PLANT ANALYSIS BY CANOPY COVERAGE METHOD
(Values are percentages based on a study of three macroplots)

Macroplot	A		B		C		Avg.	
	Cov.	Fr.	Cov.	Fr.	Cov.	Fr.	Cov.	Fr.
Brake-fern	70.4	94	51.6	82	74.4	96	65.44	90.66
Trailing Blackberry	12	84	13.25	68	15.25	92	13.5	81.32
Purple Pea	9.9	60	12.3	66	13.1	82	11.77	70
Tansy	12.34	42	1.25	10	18.4	82	10.67	44.66
Annual Brome	10.15	54	6.25	22	11.2	54	9.2	43.32
Velvet Grass	4.25	30	11.65	46	10.8	68	8.90	48
Pearly Everlasting	3.2	12	5.3	30	8.7	46	6.4	
Ox-eyed Daisy	2.85	16	5.45	26	8.85	38	5.72	26.66
Fire weed	9.5	22	1.8	14	3.1	20	4.8	18.66
Hazel	9.5	8	-	-	.3	2	3.3	3.33
Vine Maple	8.15	14	-	-	-	-	2.72	4.66
Oregon Grape	-	-	3.55	16	3.8	44	2.45	10
Star Flower	2.2	48	2.7	50	1.1	34	2	44
Wild Ginger	.1	4	.5	10	5.1	36	1.9	16.66
Twisted Stalk	3.4	38	.65	6	1.15	16	1.73	20
Lily-of-the-Valley	X		X		5.05	10	1.68	3.32
Hairy Cat's Ears	3.2	42	.2	8	X		1.1	16.66
Vancouveria	X		2.7	28	X		.9	9.32
Trailing Yellow Violet	1.45	38	.1	12	.2	8	.88	19.32
Thimble Berry	X		.85	6	1.6	14	.82	6.66
Crow's Foot	X		X		2.05	8	.68	2.66
Salal	X		2.15	10	X		.72	3.33
Galium	.5	20	1.1	42	.1	4	.57	11
Canadian Thistle	X		X		1.5	10	.5	3.33
Red Flowering Current	X		X		1.25	2	.42	66
Wild Rose	X		X		.8	4	.3	1.32
White Clover	.45	8	.3	2	X		.25	3.32
Henderson's Sedge	X		X		.75	2	.25	.66
Trillium	.35	4	.3	4	X		.2	2.66
Fox Glove	X		.6	4	X		.2	1.32
Stinging Nettle	X		X		.6	2	.2	.66
Osmorhiza	.35	4	.05	2	.15	6	.18	4
English Plantain	X		X		.35	4	.12	1.32
Scouler's Campanula	X		X		.3	14	.1	4.66
Siberian Miner's Lettuce	X		.05	2	.05	2	.08	1.32
Self Heal	X		.16	6	.05	2	.07	2.66

X = Denotes Trace

DATA FROM PLANT ANALYSIS (Cont'd.)

Macroplot	A		B		C		Avg.	
	Cov.	Fr.	Cov.	Fr.	Cov.	Fr.	Cov.	Fr.
Sword-fern	X		.05	2	.3	2	.03	1.33
Lotus spp.	X		X		.05	4	.02	1.33
Red Huckleberry	X		X		.05	2	.01666	
Blueberry Elder								
Indian Thistle								
Ocean Spray								

X = Denotes Trace

BRAKE-FERN DIVISION
DENSITY OF TREES BY SIZE CLASSES
(Numbers of individuals on three 15 X 25 meter plots)

	Diameter at Breast Height*																							
	0-1 diam. under 0.5 under 1 m in height macroplot				Over 1 m in height macroplot				Over 0.5 macroplot				1-2 diam. macroplot				2-3 diam. macroplot				3-4 diam. macroplot			
Species	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.
Alder	1			0			1	0				0				0				0				0
Broad-leaf Maple				0	9	10	12	10		10	3	4		19		6				0				0
Cherry				0		4	2	2		2		1				0				0				0
Douglas Fir	3	27	5	14	11	7	4	7	19	4		7	1			0	2	1		1	1			0
Willow				0				0				0	3	5		2				0				0

*4-5 and 5-6 diam. macroplots showed only 0.

SALAL DIVISION
DATA FROM PLANT ANALYSIS BY CANOPY COVERAGE METHOD
(Values are percentages based on a study of three macroplots)

Macroplot	A		B		C		Avg.	
	Cov.	Fr.	Cov.	Fr.	Cov.	Fr.	Cov.	Fr.
Salal	81.2	96	59.85	98	61.4	96	67.48	96.66
Brake-fern	29.7	66	34.55	72	12.8	42	25.75	60
Oregon Grape	8.1	36	29.95	56	8.4	22	10.15	38
Trailing Blackberry	4.55	36	5.85	36	5.5	34	5.3	35.23
Sierra Nevada Pea	1.65	20	6.05	20	6.35	20	4.64	20
Red Huckleberry			.05	2	12.35	14	4.33	5.32
Annual Brome	.8	12	.35	14	9.44	36	3.53	20.66
Common Horsetail					7.85	10	2.62	3.33
Hazel	3.25	4	3.7	4			2.38	2.66
Starflower	1.65	26	2.95	60	2	30	2.20	38.66
Thimble Berry	.35	4			4.45	16	1.60	6.66
Pearly Everlasting	.15	6	2.65	26	1.85	4	1.55	13.32
Fireweed	1.15	16	2.3	22	.6	22	1.35	14
Vine Maple	8.46	12			1.95	2	.94	4.66
Orchard Grass			2.8	8			.93	2.66
Crow's Foot	.25	10			.3	2	.59	4
Velvet Grass	.05	2	1	30	.3	2	.45	11.32
Ox-eyed Daisy					.9	6	.3	2
Trailing Yellow Violet	.15	6	.3	12	.05	2	.16	6.66
Indian Plum	.58	6					.19	2
Wild Ginger			.05	2	.3	2	.12	1.32
Polypody					.3	2	.1	.66
Trillium			.05	2	.04	4	.03	2
Circea					.1	4	.03	1.32
Ocean Spray	.1	2					.03	1.32
Twisted Stalk			.05	2			.02	.66
Hairy Cat's Ears			.05	2			.02	.66
Stellaria					.05	2	.02	.66
Nemophilia					.05	2	.02	.66
Columbine								
Henderson's Sedge								
Sword-fern								

SALAL DIVISION
DENSITY OF TREES BY SIZE CLASSES
(Numbers of individuals on three 15 X 25 meter plots)

	Diameter at Breast Height*																							
	0-1 diam. under 0.5 under 1 m in height macroplot				Over 1 m in height macroplot				Over 0.5 macroplot				1-2 diam. macroplot				2-3 diam. macroplot				3-4 diam. macroplot			
Species	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.
Alder				0	1	3	5	3	4	5	6	5	1	2	1	1	1			0	2			1
Broad-leaf Maple				0			4	1		5	2	2	1	1		1	5	5		3				0
Cherry				0				0		19		6	2			1				0				0
Douglas Fir		1		0	3		1	1	1		5	2	1		5	2				0	3			1
Willow				0				0				0	2			1				0				0

*4-5 and 5-6 diam. macroplots showed only 0.

SWORD-FERN DIVISION
DATA FROM PLANT ANALYSIS BY CANOPY COVERAGE METHOD
(Values are percentages based on a study of three macroplots)

Macroplot	A		B		C		Avg.	
	Cov.	Fr.	Cov.	Fr.	Cov.	Fr.	Cov.	Fr.
Sword-fern	85.55	92	70.7	84	79.95	92	78.07	82.32
Vine Maple	11.7	12	X		19.5	20	10.4	10.66
Siberian Miner's Lettuce	5.4	32	9.5	62	13.65	64	9.52	52.66
Oregon Grape	16.9	54	3.5	24	6.5	26	8.97	34.66
Nemophila	7.95	38	5.3	38	9.65	60	7.63	45.32
Slender Stemmed Water-leaf	6.95	22	7.95	22	5.2	18	6.7	20.66
Brake-fern	.35	4	11.5	20	4.35	18	5.60	14
Bedstraw	10.25	50	5.1	48	.3	2	5.21	33.32
Trailing Blackberry	3.25	22	8.95	42	2.85	16	5.01	26.66
Annual Brome	5.95	20	1.8	12	2.55	8	3.41	13.32
Hazel	X		2.25	4	5.85	6	2.7	3.32
Circea	X		.85	6	3.9	30	1.58	12
Western Sweet Cicely	4.2	14	X		X		1.4	2.33
Smooth Fairy Bells	2.5	14	.3	2	X		.9	5.32
Velvet Grass	X		2.34	8	X		.78	2.66
Red Flowering Current	4	4	X		X		.7	1.32
Twisted Stalk	.85	6	X		.95	10	.6	5.32
Henderson's sedge	1.8	6	X		X		.6	2
Trillium			1.55	6	.05	2	.53	2
Osmorhiza					1.5	4	.5	1.32
Vancouveria			1.1	6	.35	4	.48	4
Stellaria	.3	2	.05	2	.75	6	.4	3.32
Large Fringe Cup	.65	6	.3	12			.32	6
Red Huckleberry	.75	2	3	2			.26	1.33
Salal			.75	2			.25	.66
Maidenhair-fern					.65	4	.22	1.33
Wild Ginger	.05	2			.5	10	.2	4
Purple Pea	.6	6					.2	2
Wild Rose	.3	2	.3	2			.2	1.33
Vanilla leaf			.6	4			.2	1.33
Fendler's Meadow Rue					.3	4	.1	1.33
Bleeding Heart					.3	2	.1	.66
Thimble Berry			.3	2			.1	.66
Mountain Dentaria	.05	2			.05	2	.03	1.33
Lily-of-the-Valley			.05	2			.02	.66
Blueberry Elder								
Bunch Berry								
Foxglove								
Polypody								

SWORD-FERN DIVISION
DENSITY OF TREES BY SIZE CLASSES
(Numbers of individuals on three 15 X 25 meter plots)

	Diameter at Breast Height*																											
	Over 1 m in height macroplot				Over 0.5 macroplot				1-2 diam. macroplot				2-3 diam. macroplot				3-4 diam. macroplot				4-5 diam. macroplot				5-6 diam. macroplot			
Species	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.
Alder	1			0	3		2	2	3		1	1	1	2	5	3		1		0	1	3		1				0
Broad-leaf Maple		10		3	5	2	6	4	3	5	10	6		2	2	1				0				0		1		0
Cherry	2		1	1	3		1	1	3			1				0				0				0				0
Douglas Fir		6	2	2		4	2	2		2		1				0				0				0	1			0
Hemlock				0		1		0				0				0				0				0				0
Willow				0				0				0				0				0				0				0

*0-1 diam., under 0.5, under 1 m in height microplot showed only 0.