A TAXONOMIC AND ECOLOGIC STUDY OF THE FLORA OF MONUMENT PEAK OREGON

by

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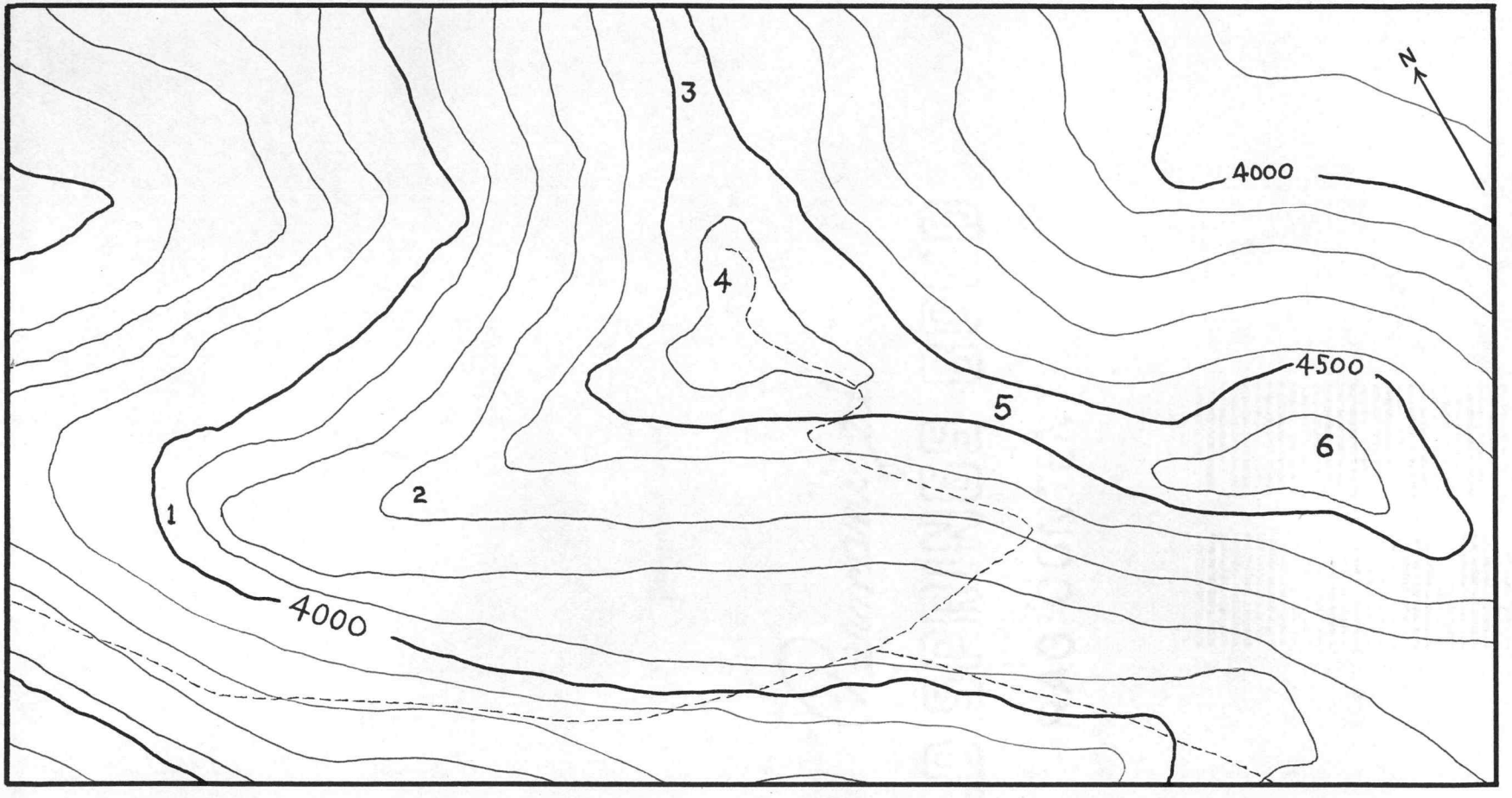
INTRODUCTION

Geographical Location

Monument Peak is located in Northeastern Linn County, Oregon on the west flank of the Cascades at Lat. N. 44°42' and Long. 122°20' W. It is approximately four miles south and seven miles east of the town of Mill City. The North Santiam River flows within five miles of the base of the mountain to the northeast. The summit on which the lookout is now located lies just outside the boundary of the Willamette National Forest, but a considerable part of the area included in the study falls within the forest limits.

The Monument Peak area consists essentially of two peaks connected by a high ridge and of two other ridges radiating out from the higher peak which in this study is designated New Monument. The second peak, the one originally named Monument, is the former site of the lookout and is designated in this paper as Old Monument. Reference to the map, figure 1, will show three ridges radiating from New Monument, one extending in a westerly



1 West Hill 3 North Ridge 5 East Ridge ---- Forest Road

2 West Ridge 4 New Monument 6 Old Monument

Fig. 1 Map of the Area Studied

direction, a second running almost directly north, and a third bearing southeast and eventually terminating in Old Monument. For convenience these three ridges are called in this paper West Ridge, North Ridge, and East Ridge respectively. It will be further noted that Old Monument has an elevation of 4683 feet and that both East and North Ridges exceed 4500 feet. New Monument is just under 4700 feet; while West Ridge drops off abruptly from the summit, falling quickly below the 4500 foot contour, and then gradually slopes off to the west. It was the purpose in this study to include all the area above 4000 feet. Actually some collections along the road on the southwest slope of West Ridge were made as low as 3600 feet but in the main the original objective was adhered to.

Objectives

The purpose of this study was as follows: (1) to collect all the species of vascular plants in the area, (2) to identify and verify the nomenclature of all the species, (3) to recognize, delimit, and analyze the plant communities occurring in the region and to assign each to its correct successional status, and (4) to determine the affinities of the flora with those of other regions.

As secondary objectives and in pursuit of the primary ones, various routines were carried out such as

constructing keys to the families, genera, and species, recording the flowering periods of the angiosperms of the area, and working out the biological spectrum of Monument Peak.

This problem was undertaken with one broad, overall objective, namely, that it might contribute to our understanding of the origins and relationships of the flora of Western Oregon. Alone it cannot aid materially in the realization of this broad objective, but it is believed that studies of such undisturbed floras of isolated peaks west of the main range of the Cascades when correlated may yield significant information on the history of these areas, and indicate trends of migration and the effectiveness of barriers to dispersal.

Scope and Methods

Because of the inaccessibility of the area from October to May, the field work was confined to the summer months. Thirty-six days or parts of days distributed over two seasons, 1947 and 1948, were spent in the area collecting, observing, identifying, and making statistical analyses. Determinations were made from fresh material where possible. Peck's Manual of the Higher Plants of Oregon was primarily used in making identifications although it was freely supplemented by Gilkey's Handbook

of Northwest Flowering Plants, Abram's Illustrated Flora of the Pacific States, Piper and Beattie's The Flora of the Northwest Coast, Hitchcock's Manual of the Grasses of the United States, Mackenzie's North American Cariceae besides numerous other keys, monographs of genera, and original descriptions of species. Representatives of all the species collected and determined were with two exceptions (Taraxacum officinale L. and Cytisus scoparius L.) pressed and mounted. Duplicates were provided for the O.S.C. Herbarium. For four of the more difficult groups, the families Polypodiaceae, Gramineae, and Cyperaceae and the Genus Epilobium, the aid of specialists was sought in checking the author's determinations. Also loans from other herbaria of specimens of certain difficult species were made for the purpose of checking identifications where the material in the O.S.C. Herbarium proved inadequate.

In the rock-fell community studies the quadrat analysis method was used for determining dominance and successional trends. Growth-ring counts made from cores obtained by the Swedish increment borer were used in the study of relict species, in helping date the last forest fire, and as an aid in determining the relative stability of certain communities.

THE PHYSICAL FACTORS

Topography and Drainage

The Monument Peak area comprising two peaks and three ridges as pointed out earlier, together with an unnamed peak of approximately equal height lying about one mile north and a ridge extending approximately a mile to the south of Old Monument, constitute the highest elevations in the entire region for several miles in any direction. Reference to the contour map, figure 2, shows the drainage pattern fanning out in all directions from the peaks and ridges referred to. Beginning with Mad Creek which heads on the northwest flank of Monument and proceeding clockwise one finds the origins of Lawhead, Kenney, and Rock Creeks in that order.

The area is characterized by mature topography with sharp ridges and narrow v-shaped valleys. Some of the slopes are so rocky and precipitious that they support very little vegetation except certain lithophytes.

Geology and Soils

Geologists hold that the Cascade Mountains were formed of two or more series of volcanic rocks. The older of these series, termed the Western Cascades, are folded and, as the name implies, extend farther west than the younger

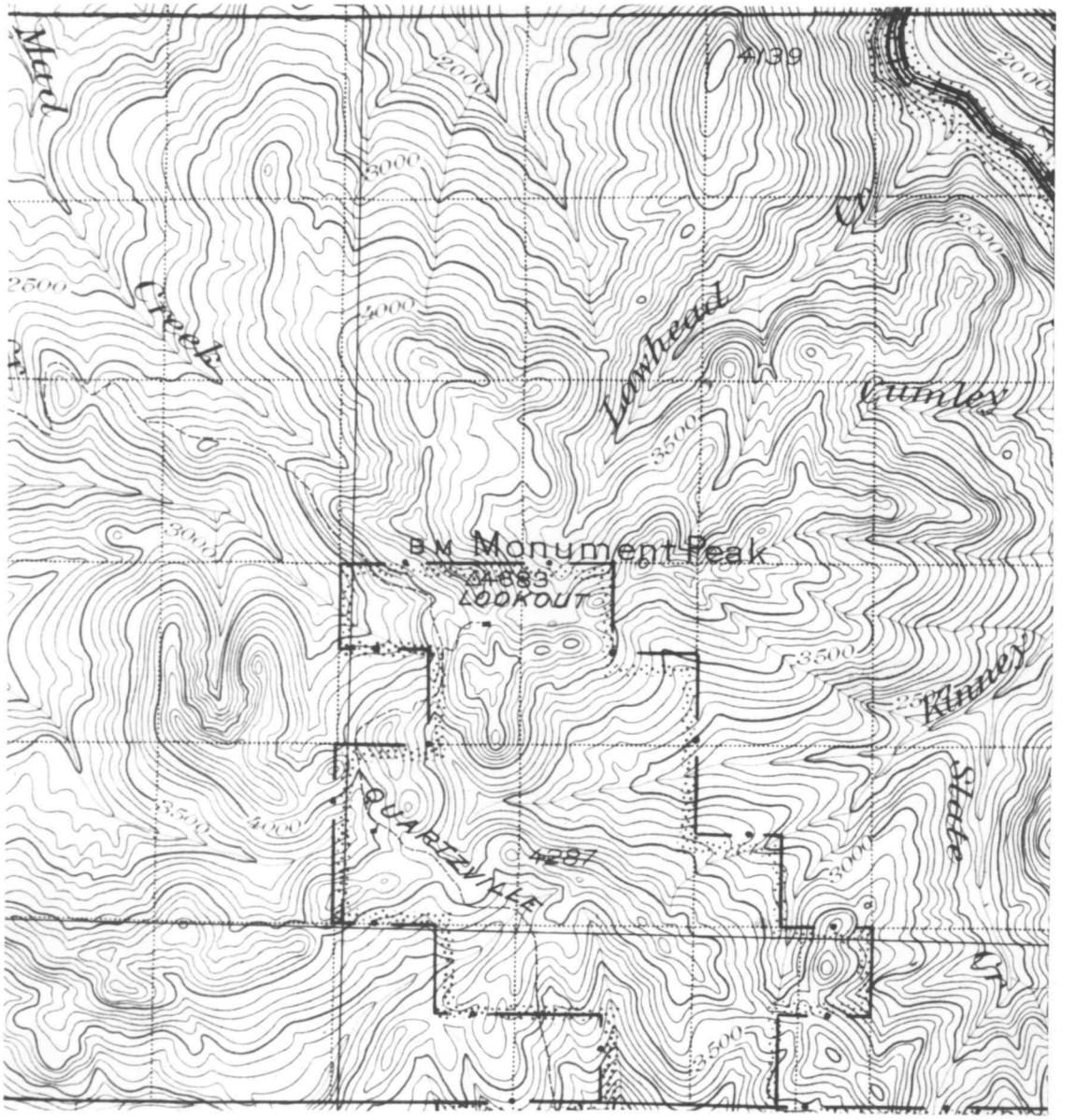


Fig. 2 Contour Map of the General Region around Monument Peak. Note the North Santiam River at the Extreme Upper Right Corner

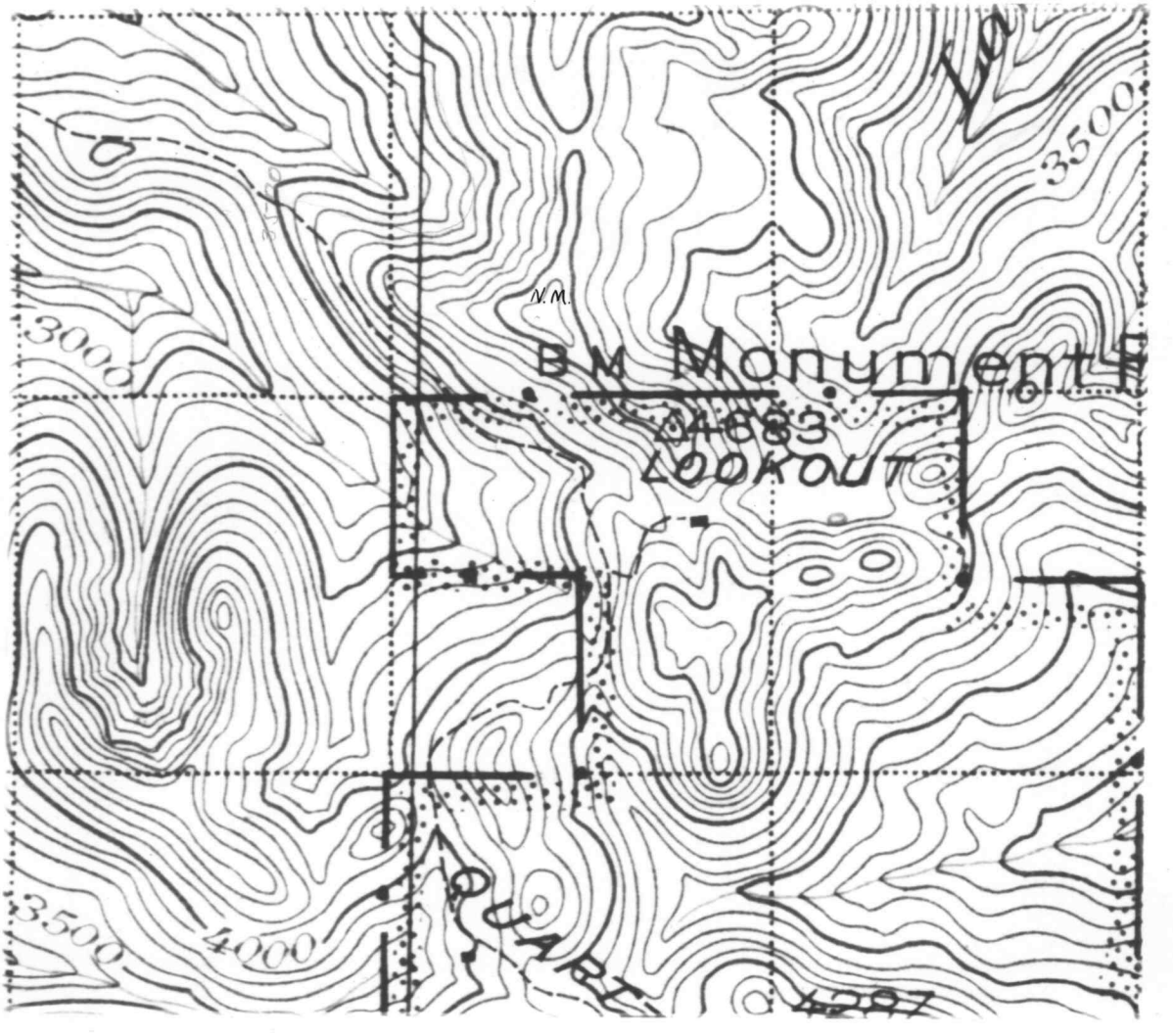


Fig. 3 Contour Map of the Monument Peak Area.
The Lookout is Actually on the Summit of
New Monument marked N.M.

unfolded series which comprise what is known as the High Cascades. These two series constitute two distinct north-south ranges and are recognizable between the North Santiam and the Rogue Rivers (54, p.1). The Western Cascades in which Monument Peak is located have an average elevation of between 4500 and 5000 feet in the area east of Salem. Its eastern border disappears under the High Cascades along a line a few miles west of Mt. Jefferson. The folding which characterizes the Western Cascades is much in evidence on Monument Peak, particularly along the ridges which radiate from New Monument.

The rocks of which the Western Cascades are composed are of Oligocene-Miocene volcanics, probably mostly Miocene, and have been folded to form gentle synclines and anticlines with their troughs and crests respectively running northeastward (54, p.1-2). Monument Peak lies in the so-called Sardine Syncline, the series composing it being known as the Sardine formation and characterized by its extreme resistance to erosion. The lavas of which it is composed are principally "andesites although they range from rhyolite to basalt and greatly predominate over the tuff and breccia" (54, p.8,15).

Because of the mountainous character of the terrain, no detailed analysis of the soil of this corner of Linn County has been made under the soil survey program. A few

general observations which have been corroborated by the author are quoted from a U.S.D.A. Bulletin on a soil survey of Linn County, Oregon. "The soils are mainly residual and are derived almost entirely from basalt or other related igneous rocks...Most of the soils are shallow and include many rock outcrops. They are prevailingly heavy in texture, brown in color, have brown or reddish subsoils and correspond in general to soils of the Olympic series" (34, p.69-70). The soil depth varies from none on the ridges at and near the summit to two feet or more in the Noble fir community. As will be pointed out later, the distribution of tree species and their complete absence in certain areas appears to be definitely linked with the edaphic factor.

Climate

Monument Peak lies in the path of the westerly winds which bring large quantities of moisture from the ocean; consequently, it has a mild climate, generally classed as a humid marine (43, p.83). The rainy season exceeds the dry period in length, with the result that there is a moisture carry-over that supports a vegetation type with rather high moisture requirements and keeps the streams flowing the entire year. No weather data are available for the exact area included in this problem; consequently

records from stations in the general region had to be studied and an attempt made to interpolate the weather conditions on Monument. The three stations used were Detroit, Mehama, and Green Peter Mountain. Reference to Table 1 will show these stations to be approximately ten miles east northeast; twenty miles west northwest and twenty-three miles southwest respectively from Monument. The records from the first two were compiled by the U. S. Weather Bureau and are quite complete as far as precipitation is concerned. The data for Green Peter on the other hand cover only the summer months and were gathered by lookout men in the employ of the Linn County Fire Patrol. According to Stovall and Hopson (43, p.89), Monument Peak lies between the 60 inch and 70 inch isohyetals. It should be noted that the precipitation for the three winter months at both Detroit and Mehama is nearly half the total amount, whereas the summer rainfall is very scanty for all three stations. It is safe to assume that the annual precipitation at Monument is somewhere between that of Mehama and Detroit and that the seasonable distribution is similar to that which characterizes the region. It is further assumed that the annual snowfall exceeds Detroit's fifty-seven inches. As stated elsewhere in this paper, there is ample evidence of a heavy snow pack in the shrub community on the south slope of the Peak. The prevailing wind direction at

TABLE 1

A COMPARISON OF THE PRECIPITATION AT THREE STATIONS

Station	Elevation	Direction and Distance from Monument Peak	Number of Years Averaged	Precipitation in Inches					
				July	Aug.	Sept.	Nov. Dec. Jan.	Mean Annual	Mean Annual Snowfall
Detroit	1452 ft.	8m. E, 2m. N	37	.69	.76	3.18	33.41	70.55	57.3
Mehama	628 ft.	14m. W, 7m. N	7	.02	.96	3.67	25.13	58.94	
Green Peter	4079 ft.	12m. W, 14m. S	20[b]	.80	.87	2.0[bb]			

[b] Only 10 years averaged for July
[bb] Only 13 years averaged for Sept.

The September average for Green Peter is in all probability higher than 2.0 over a period of years because precipitation data were gathered only when September was dry enough to warrant keeping the lookout open for fire patrol purposes.

Detroit is west for every month of the year.

The date of the beginning of the growing season apparently varies considerably from year to year on Monument. For instance, Dr. Helen Gilkey on June 8, 1944, at 4000 feet collected three species of Anemone all of which were at the height of their flowering stage. At almost the same day of June in 1945, the same area was covered by four feet of snow. (Oral communication by Dr. Frank Smith) Then on June 13, 1947, there was no trace of snow anywhere on the mountain and the Anemones along with several other species exhibited mature fruits instead of flowers.

HISTORICAL FACTORS

Fires

No records of forest fires or of logging operations have been kept for the Monument Peak Area; consequently, information had to be gleaned from the memory of people living in the area. The author was able to secure some interesting data from Mr. L. T. Henness who has lived in the Gates-Mill City area since 1864, and who now resides approximately two miles south and one mile west of Gates. The memory of Mr. Henness appeared to be very keen and his intimate and continuous familiarity with Monument Peak since the late 1860's seems to be a fact beyond question. He has hunted the area year after year and to use his own words he knows "almost every rock on the mountain."

Mr. Henness recalls the last forest fire which involved the Monument Peak area. It is designated as the "Rock Creek fire" and was a rather disastrous conflagration. It started in a canyon southeast of Old Monument and is said to have moved west and northwest. Mr. Henness gives the approximate date of this fire as 1900. Charred remains of stumps and huge dead snags bear evidence of a serious burn in the area at sometime in the past. The Oregon Pulp and Paper Company, the owners of Section 16, which includes New Monument, west ridge, north ridge, and

Fig. 4 Looking East-southeast at West Hill with New Monument in the Background showing Results of an old Burn.

Fig. 5 North Slope of East Ridge as seen from North Ridge showing Evidence of a Forest Fire.

a portion of east ridge indicates from its records that New Monument was burned off some fifty to sixty years ago and that the fire may have extended south into the north half of the adjacent section.

Lumbering

Valid information with regard to logging operations in the area could not be obtained. Mr. Henness indicated that the Hammond Lumber Company of Portland did some cutting on the south and west slopes of the Peak shortly after the turn of the century, but the office of the company shows no record whatsoever of logging there. The present owners of Section 16 insist that there has been no cutting on the area since they secured it. It may then be concluded that there has likely been no extensive or significant disturbance of the timber by logging operations during the past fifty years and possibly never.

Grazing

According to the testimony of Mr. Henness, eighteen hundred head of sheep were pastured over Monument Peak in approximately the year 1908. Except for this one season, however, the area appears never to have been extensively grazed by domestic animals in the memory of man.

THE VEGETATION

General Considerations

The west slope of the Oregon Cascades belongs to the Coast Forest Formation designated by Clements as the Thuja-Tsuga Association (57, p.481, 500-502). However, Thuja is almost entirely excluded, apparently by altitude, from the area included in this study. It is replaced by Abies procera Rehd. and Abies amabilis (Dougl.) Forbes. It seems advisable, therefore, to assign the term Abies-Tsuga Association to the forest vegetation of the area. Pseudotsuga taxifolia (Lambert) Britt. and Pinus monticola Dougl. are apparently not constituents of the climax forest but occur rather as seral dominants occupying areas from which the climax dominants are excluded by edaphic factors. Both are characteristic species in the ecotone regions between the forest communities and the rocky treeless areas near the summits. Chamaecyparis nootkatensis (Lamb.) Spach. is represented by an occasional specimen or clump of trees and is to be regarded as a relict species. Tsuga Mertensiana (Bong.) Sarg., found sparingly in the area, apparently occurs here at the extreme lower limits of its range. Neither Chamaecyparis nootkatensis nor Tsuga Mertensiana was found by the author on Snow Peak or Green Peter Mountain, each with elevations slightly above

4300 feet. The former is approximately thirteen miles west southwest of Monument and the latter twenty miles southwest.

Life Zones

A sharp border between the Canadian and the Transition Zones is typically lacking in Oregon although a marked increase in the percentage of Tsuga heterophylla (Raf.) Sarg. on the west slope of the Cascades is a good indication that one is passing from Transition to Canadian (43, p.107). There is rather general agreement among recent students of taxonomy and ecology of the Cascades in recognizing Tsuga heterophylla (Raf.) Sarg., Pinus menticola Dougl., Abies amabilis (Dougl.) Forbes and Abies procera Rehd. as four of the most characteristic trees of the Canadian on the west slope of the Cascades (43, p.107) (44, p.21)(31, p.9). These four species plus Pseudotsuga taxifolia (Lambert) Britt. account for most of the forest area on Monument Peak. Bailey included Chamaecyparis nootkatensis (Lamb.) Spach. in and excluded Abies procera from his list of trees characterizing the Canadian Zone in the Oregon Cascades (4, p.28). Tsuga Mertensiana (Bong.) Sarg. and Chamaecyparis nootkatensis both of which are found on Monument are listed by Peck (44, p.21) as two trees characteristic of the Hudsonian Zone. On the other

hand, Monument has five of the six species of shrubs which Jones (31, p.10) lists as characteristic of the Canadian Zone of Mt. Rainier. Of the fifty-five species which Professor Peck lists as among the typical and/or very abundant forms of the Canadian Zone of the Oregon Cascades, thirty species were collected by the author on Monument Peak which represents 55 per cent of the total number in Peck's list. Of the sixty-six species most characteristic of the Hudsonian according to Peck, sixteen or 24 per cent are found on Monument at or above the 4000 feet level. Obviously the area would seem to represent an overlapping of two life-zones; however, the author, feeling that more significance should be attached to the indicator trees and shrubs than to herbaceous species, concludes that the area included in the study lies predominantly in the Canadian Life-Zone.

Life-Forms and the Biological Spectrum

To determine the effect of environment factors on plants, various instrumental measurements of the factors have been used. Many data have been compiled and attempts made to evaluate them in terms of their effect on organisms but with rather unsatisfactory results. Some investigators recognizing that the mechanical measurement of individual factors is inadequate since the responses of plants

represent a sum total of the combined effect of all the environmental factors plus the limits of adjustment inherent in the organism, have contended that the plant itself is the best measure of the total environment. One such investigator was the Danish botanist, Raunkiaer (48), who developed a simple, but biologically sound, system which purports to show that a correlation exists between the proportion of life forms and the climate of a region. The life-form classification is based on the position and protection of the perennating organs of the plant during the unfavorable season. Five groups are distinguished on this basis; they are as follows:

1. Phanerophytes (Ph): Buds aerial, at least 25 cm. above ground.
2. Chamaephytes (Ch): Buds above the surface, protected by snow or dead leaves.
3. Hemicryptophytes (H): Buds at soil level.
4. Cryptophytes (Cr): Buds buried in the soil.
5. Therophytes (Th): Annuals

Raunkiaer chose ten groups of plants each of 100 species, so distributed in Index Kewensis that an interval of 250 pages separated the beginning of each group from the next. The last cited species in a column for 100 consecutive columns was chosen in each group. In this way 1000 species were obtained which he believed constituted a

fairly representative sample of the flora of the world (48, p.429-431). He then calculated the percentage of the total which each life-form represented and regarded this as a hypothetical normal spectrum of the world. The biological spectrum of a region is obtained by determining the life-form of all the species found there, and then computing the percentage of species belonging to each group. Deviations from the normal spectrum are significant indicators of the climate of a region. For example, the proportion of therophytes is typically very high in sub-tropical and warm-temperate deserts while the phanerophytes as a class properly belong to warm moist regions. The latter attain their highest percentages in the tropical rain forest and are entirely absent in the Arctic-alpine Zone. A hemicryptophytic climate is characteristic of the temperate regions of the earth, while chamaephytes reach their highest percentages in the Arctic-alpine Zone (38, p.689-691). Obviously one of the important values to be derived from Raunkiaer's system is in the comparing of the biological spectrum of one region with that of another. Reference to Table 2 illustrates one such use. The biological spectrum of Monument Peak corresponds more closely to the spectra of the Canadian Zones of Mt. Rainier and the Olympic Peninsula than to those of the Hudsonian Zones of the two regions, and in this way supports a conclusion

TABLE 2

A COMPARISON OF THE BIOLOGICAL SPECTRA OF MONUMENT PEAK WITH THAT FROM CERTAIN LIFE ZONES FROM OTHER AREAS

Region	Percentage of Species				
	Ph	Ch	H	Cr	Th
Mt. Rainier - Canadian Zone	11	8.0	47	31	3
Olympic Peninsula - " "	12	7.0	49	31	1
Monument Park (4000'-4700')	12.4	8.0	53	21	5.6
Olympic Hudsonian "	9	10	67	13	1
Mt. Rainier Hudsonian "	9	14	61	13	1

TABLE 3

A COMPARISON OF SEVERAL PHYTOGEOGRAPHICAL REGIONS

Region	Percentage of Species				
	Ph	Ch	H	Cr	Th
Monument Peak (3600'-4700')	14.0	7.5	51.6	21.1	5.8
Willamette Valley	10.7	2.3	29.7	24.0	33.1
Cascade Mountains	10.2	9.5	35.8	37.2	7.3
Blue & Wallowa Mountains	12.7	11.8	48.2	24.6	2.7
Death Valley	26.0	7.0	18.0	7.0	42.0
Spitzbergen	1.0	22.0	60.0	15.0	2.0
Seychelles	61.0	6.0	12.0	5.0	16.0
Normal Spectrum	46.0	9.0	26.0	6.0	13.0

drawn earlier that the area studied on Monument Peak is predominantly Canadian above 4000 feet.

The percentages for Monument Peak in Table 2 are based on 266 species all of which were found at 4000 feet or above, while the figures in Table 3 include 14 additional species found between 3600 and 4000 feet. Eleven of the 14 species are characteristically Transition Zone plants; therefore, it seems advisable to omit them when computing the biological spectrum to compare with the spectra from Canadian Zones.

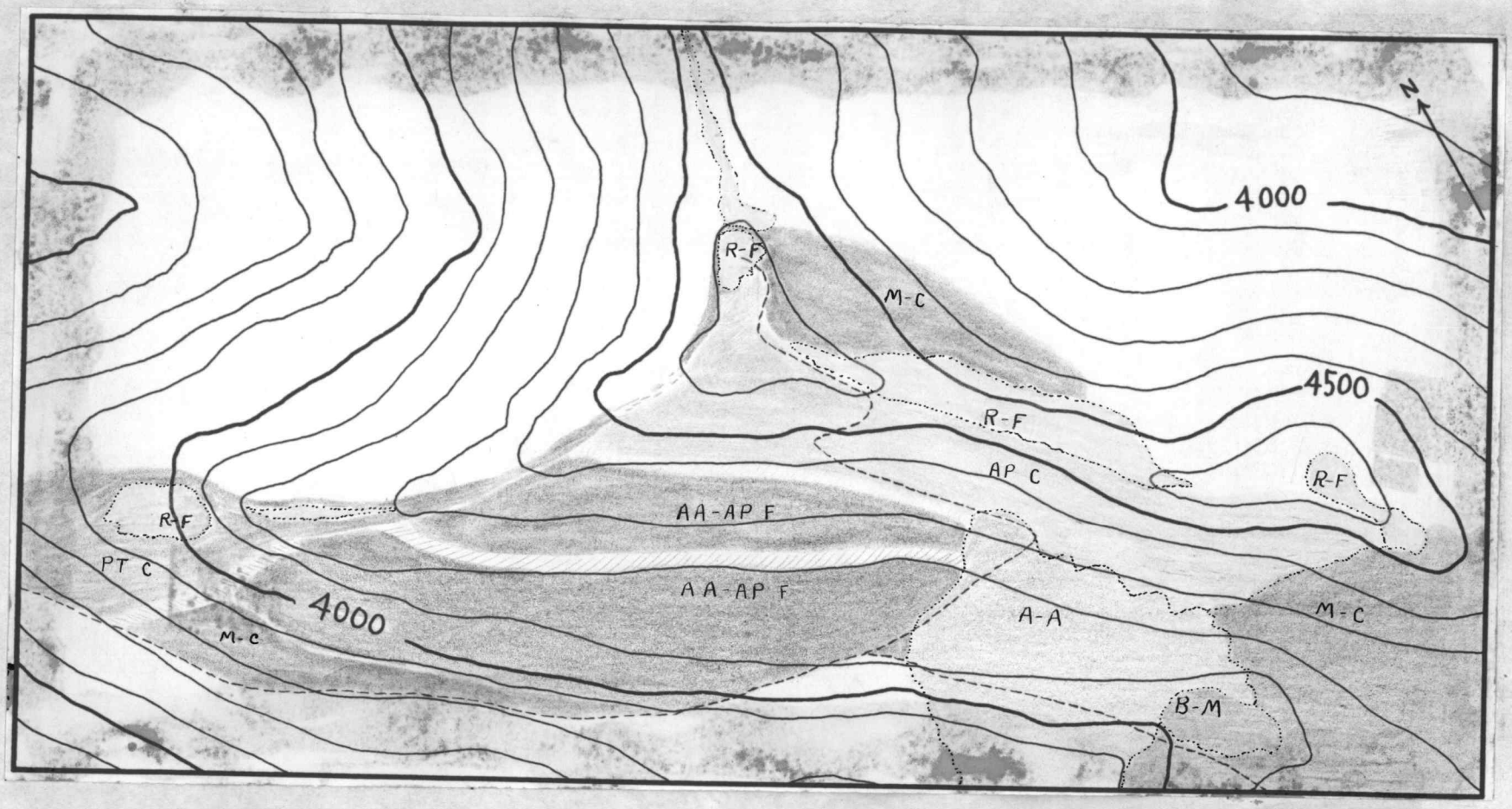
A comparison of the biological spectrum of the Willamette Valley with that of Monument Peak reveals sharp contrasts in the percentages of chamaephytes, hemicryptophytes, and therophytes. The proportionately greater number of therophytes in the Willamette Valley is attributed to two factors: (1) the large number of adventives, a great portion of which are annuals, and (2) the greater aridity of the summer climate. The lack of severe freezing temperatures in the region would account for fewer chamaephytes. Most shrubs find climatic conditions favorable for vertical growth beyond 25 cm. The smaller per cent of hemicryptophytes in the Willamette Valley loses some of its significance when it is noted that the proportion of hemicryptophytes has decreased as the proportion of cryptophytes and therophytes has

increased and that by actual count the Willamette Valley has a greater number of species of hemicryptophytes than has Monument Peak.

It will be noted that the Cascades Mountains as a whole and also the Blue and Wallowa Mountains have a smaller percentage of phanerophytes but a greater percentage of chamaephytes than has Monument, which is attributable to more severe climatic conditions found in the former region. The low proportions of phanerophytes and therophytes at Spitzbergen, the high percentage of therophytes in Death Valley, and the high proportion of phanerophytes in the Seychelles Islands in the Indian Ocean illustrate the generalizations stated earlier.

The Plant Communities

Four major plant communities occur on Monument Peak. They are (1) a rock-fell community, (2) the coniferous forests, (3) a shrub community, and (4) the bog-marsh. Some of these have geographic continuity, while others consist of non-contiguous fragments. Only the forest communities are climax, the other three being seral. Distinct units of vegetation are recognizable in some of the communities and are treated independently. For example, the coniferous forests collectively constitute an Abies-Tsuga Association with three climax dominants,



AA-TH F Abies amabilis-Tsuga heterophylla Faciation AP C Abies procera Consociation
AA-AP F Abies amabilis-A. procera Faciation PT C Pseudotsuga taxifolia Consocies
R-F Rock-fell B-M Bog-Marsh A-A Acer-Alnus M-C Mixed Conifer

Fig. 6 Plant Communities on Monument Peak

namely, Tsuga heterophylla, Abies procera, and A. amabilis with Pseudotsuga taxifolia playing the role of a seral or sub-climax dominant. In this association two faciations and one consociation are recognized and treated independently. Distinct associes are recognizable in some of the seral communities while in others the units of vegetation are not so clearly differentiated. Reference to figure 6 will show the geographic location of the various communities and their sub-divisions.

The Rock-Fell Community

Treeless areas occur at the summits of both New Monument and Old Monument, along the ridge connecting them and to a lesser extent on North Ridge and West Ridge. This timberline is attributable to physiographic rather than to climatic factors. The largest single fragment of this disjunctive community is on West Hill at an elevation of about 4100 feet. The area is essentially a west-southwest exposure approximately 100 yards in east-west direction and averages about 55 yards in width. An estimated one-third of the area is a rock outcrop supporting only a few lichens and other lithophytes, the most abundant of which are Rhacomitrium lanuginosum (Hedw.) Brid. and Selaginella Wallacei Hieron. Another third of the area is characterized by shallow, gravelly soil more

Fig. 7 West Hill with the Rock-fell Community appearing as a Small Treeless Area High in the Foreground

than half bare but supporting typically certain chersophytes such as Lomatium Martindalei C. & R., Allium cascadense Peck, Eriophyllum lanatum (Pursh) Forbes, Polygonum aviculare L., Microsteris gracilis (Dougl.) Greene, Festuca rubra L., Agrostis diegoensis Vas. Arctostaphylos nevadensis Gray, Montia parvifolia (Moc.) Greene, Saxifraga rufidula (Small) Johns, and Phlox diffusa Benth. longistylis (Wher.) Peck. The remaining portion of the hill is characterized by more nearly level areas covered by a mantle of soil thick enough to support a more or less complete plant cover in which psilophytes predominate. Typical species are Festuca rubra L., Agrostis diegoensis Vas., Luzula campestris (L.) DC. var. multiflora (Ehr.) Celak., Fragaria platypetala Rydb., Erythronium oregonum Appleg., and Eriophyllum lanatum.

This treeless island is surrounded by a forest in which western hemlock (Tsuga heterophylla) and Douglas fir (Pseudotsuga taxifolia) are the principal trees. A narrow ecotone separates the forest from the rock-fell community with Penstemon nemorosus (Dougl.) Trautv., Lupinus latifolius Agh. var. subalpinus (Piper and Robbins) C.P. Sm., Amelanchier florida Lindl., Rubus parviflorus Nutt., Rosa gymnocarpa Nutt., Salix sitchensis Sans., Rhododendron macrophyllum C. Don, and Vaccinium membranaceum Dougl. and seedlings of Douglas fir as typical species.

That the rock-fell community is gradually shrinking is evidenced by the presence of seedlings and small trees of Douglas fir which are invading the margins. Near the center of the area on a comparatively level spot grows a single specimen of Oregon white oak (Quercus Garryana Dougl.). Its form of growth is very shrubby, for although the crown is some 12 feet by 6 feet in horizontal dimensions, it attains a height of only about 18 inches.

The nearest white oak to this locality is at the base of the mountain some four to five miles distant and growing at an elevation of approximately 1000'. The presence of this lone specimen at 4100' is best explained by regarding it as a relict of a dry period between 8000 and 4000 years ago when oaks were probably common at elevations up to 3000' to 4000'. The occurrence of a postglacial xerothermic period at about this time is well substantiated by pollen profiles of Willamette Valley bogs as well as those from other parts of the Pacific Northwest (19, p.4, 31, 112 & 121). This species persisted here because its coniferous competitors have found this micro-community too xeric for invasion.

The other fragments of the rock-fell community though differing in their exact floristic content are essentially similar. At the summit of New Monument is a treeless area with a southwest slope. It is approximately circular in

Fig. 8 The Rock-fell Community at the Summit of New Monument

in outline with an average diameter of about 55 yards. It has a few rock outcrops but a large proportion of it is covered by a soil mantle of varying depths. On the north the area is bounded by an almost perpendicular cliff 200 feet in height. East Ridge is very rocky near the top with a precipitous north face which supports nothing but a few lithophytes. On the less steep south slope more soil has accumulated and supports a richer flora. The ecotone here and at the summit of New Monument separating the rock-fell community from the Noble fir forest is sharp and characterized by western white pine (Pinus monticola Dougl.) and Douglas fir, along with Holodiscus discolor (Pursh) Maxim. and Amelanchier florida Lindl. as the principal shrubs. (See figure 9)

Another small fragment of this community is found at the summit of Old Monument and on an adjacent southeast slope. This small area yielded four species, (Eriogonum nudum Dougl., E. compositum Dougl. var. pilacaule St. John & Warren, Haplopappus Hallii Gray, and Gayophytum humile Juss.) not found elsewhere.

Quadrat studies were made on West Hill and at the summit of New Monument to determine the dominant species. Various size quadrats from one quarter meter to eight square meters were experimented with until it was found that the one meter square was the minimal size for accurate results.

Fig. 9 East Ridge Looking East with the Rock-fell Community on the Left, the Noble Fir Consociation on the Right and the Ecotone of Amelanchier florida and Holodiscus Discolor

On West Hill 20 quadrats were laid out in three parallel rows using an interval of 14 yards between quadrats. Twenty quadrats were used on New Monument likewise but because of the smaller size of the area to be sampled, the quadrat interval was shortened to ten yards. Five coverage classes were recognized as follows:

1. 1-5% coverage
2. 6-25% coverage
3. 26-50% coverage
4. 51-75% coverage
5. 76-100% coverage

Coverage data were obtained from careful estimates of the areas within the quadrats. In computing the mean coverage of a given species the coverage percentages it possessed in the various quadrats were averaged. In making this computation the midpoint in terms of per cent in each class was arbitrarily used. For example, if Eriophyllum lanatum in quadrat 4 belonged to cover class 3, its coverage percentage was arbitrarily set at 38 in the averaging procedure.

It will be noted by referring to Table 4 that Eriophyllum lanatum was found in every one of the 20 quadrats taken on West Hill, giving it a frequency of 100%; and that it had a relatively high coverage, being surpassed by only two other species. Similarly Festuca

rubra and Agrostis diegoensis have high frequencies and relatively high coverages. It is quite clear that all three species are seral dominants in the grass-forb stage of xerach succession. Rhacomitrium lanuginosum, a true moss, and Selaginella Wallacei, a pteridophyte, both lithophytes, rank second and fifth respectively in coverage and both show rather high frequencies. It is clear that both are seral dominants representing a stage of succession only once removed from the pinoeer lithophytes. In late June three species namely, Phlox diffusa var. longistylis, Castilleja hispidia, and Eriophyllum lanatum create an aspect. However, only the last species can be regarded as a dominant.

The data from the quadrats taken at the summit of New Monument are in substantial agreement with those obtained from West Hill. For example, Eriophyllum lanatum, Rhacomitrium lanuginosum, and Festuca rubra are clearly dominants in this area as they were on West Hill. Selaginella Wallacei, Calochortus Lobbii, and Lomatium Martindalei all continue to register high frequencies and their coverage values show little change. By way of contrast, however, the number of species is significantly larger. Seven species of grass are found here to only two for West Hill. Agrostis diegoensis is not as important a constituent of the flora as it was on West Hill. It has only half the coverage it showed on West Hill while its

TABLE 4

FREQUENCY & COVERAGE DATA FOR WEST HILL

Species	Frequency %	Coverage %
Eriophyllum lanatum	100	9
Rhacomitrium lanuginosum	85	13
Festuca rubra	80	9
Agrostis diegoensis	80	7.5
Polygonum aviculare	75	1.0
Castilleja hispida	70	1.4
Calochortus Lobbii	65	2.0
Lomatium Martindalei	60	1.8
Selaginella Wallacei	60	4.3
Saxifraga rufidula	55	1.0
Montia parvifolia	55	1.0
Sedum spathulifolium	40	1.2
Phlox diffusa var. longistylis	40	3.7
Allium cascadense	40	1.2
Comandra umbellata	40	1.0
Arctostaphylos nevadensis	35	16.0
Microsteris gracilis	25	.75
Saxifraga ferruginea	20	.6
Luzula campestris	20	.6
Cryptogramma acrostichoides	15	.45
Orobanche uniflora	10	.3
Xerophyllum tenax	10	.3
Polytrichum juniperinum	5	.15
Erythronium oreganum	5	.15
Achillea lanulosa	5	.8
Delphinium Menziesii	5	.15
Juniperus sibirica	5	1.0
Pseudotsuga taxifolia (seedling)	5	.15

Other species in this Rock-Fell Community not obtained in the quadrats:

Quercus Garryana
Castilleja miniata
Hieracium albiflorum
Lilium columbianum
Penstemon nemorosus
Epilobium lactiflorum
Rhododendrom macrophyllum
Antennaria concolor
Carex inops

TABLE 5

FREQUENCY & COVERAGE DATA FOR THE ROCK-FELL COMMUNITY AT THE SUMMIT OF NEW MONUMENT

Species	Frequency %	Coverage %
Festuca rubra	90	14.3
Eriophyllum lanatum	90	9
Penstemon procerus	65	4.5
Selaginella Wallacei	60	2.5
Calochortus Lobbii	60	1.8
Rhacomitrium lanuginosum	60	10.4
Lomatium Martindalei	60	1.8
Agrostis diegoensis	45	3.7
Polytrichum juniperinum	40	1.2
Saxifraga rufidula	40	1.2
Arctostaphylos Uva-ursi	40	10
Achillea lanulosa	40	2.5
Polygonum aviculare	40	1.2
Castilleja hispida	35	1
Sedum spathulifolium	30	.9
Comandra umbellata	25	.75
Rosa Spaldingii	25	1.4
Zygadenus venenosus	25	.75
Silene Douglasii	25	.75
Cryptogramma acrostichoides	25	.75
Luzula campestris	25	.75
Erythronium grandiflorum var. pallidum	15	.45
Heuchera micrantha var. pacifica	15	.45
Antennaria concolor	10	3.8
(An unidentified crustose lichen)	10	.3
Hieracium albiflorum	10	1.
Fragaria platypetala	10	.3
Gilia capitata	10	.3
Juniperus sibirica	10	9.
Pachystima myrsinites	10	.3
Hemizonella minima	10	.3
Penstemon Cardwellii	10	2.0
Orthocarpus imbricatus	10	.3
Epilobium angustifolium	5	.15
Anemone oregana	5	.15
Mimulus Breweri	5	.15
Lupinus latifolius var. subalpinus	5	.15
Allium cascadense	5	.15
Habenaria saccata	5	.15
Montia parviflora	5	.15

TABLE 5 (CONTINUED)

Species	Frequency %	Coverage %
Carex inops	5	.15
Juncus effusus	5	.15
Sedum divergens	5	.15
Berberis Aquifolia	5	.15
Potentilla glandulosa	5	.15
Ceanothus velutinus	5	.8
Penstemon serrulatus	5	.15
Anaphalis margaritacea	5	.15

Other species in the community but not obtained in the quadrats.

Hieracium chapacanum
Penstemon rupicola
Collinsia parviflora
Erysimum asperum
Rumex Acetosella
Arenaria macrophylla
Delphinium Menziesii
Eriogonum umbellatum
Saxifraga bronchialis
var. austromontana
Saxifraga ferruginea
Xerophyllum tenax
Rubus lasiococcus
Lilium Washingtonianum
Polygonum Bistortoides
Chamaecyparis nootkatensis
Tsuga Mertensiana
Poa secunda
Danthonia intermedia
Festuca occidentalis
Trisetum canescens
Elymus glaucus
Carex Rossii
Juncus Parryi

frequency at the summit was only 45% as compared to 80% for the other location. These differences are largely attributable to a greater depth of soil and to a consequently slight amelioration of the habitat from the standpoint of water relations.

Micro-community Succession

Several stages in xerarch succession are clearly demonstrated by the vegetation of West Hill. Some of the rocky outcrops are covered with unidentified species of crustose lichen while others have had sufficient soil formed on their surfaces to support certain carpet mosses such as Rhacomitrium lanuginosum and Polytrichum juniperinum and the pteridophyte, Selaginella Wallacei. Rooting in the crevices are Sedum spathulifolium, and Saxifraga rufidula. The soil-forming and soil-holding reactions of these moss-stage species pave the way for two small annuals, Polygonum aviculare and Gilia capitata, as well as for various xerophytic perennials of which the following are typical: Phlox diffusa var. longistylis, Heuchera micrantha var. pacifica and Montia parvifolia. When a little more soil has accumulated Eriophyllum lanatum, Lomatium Martindalei, Allium cascadense, Festuca rubra, Agrostis diegoensis, Castilleja hispida, and Calochortus Lobbii take over the space. Surrounding the

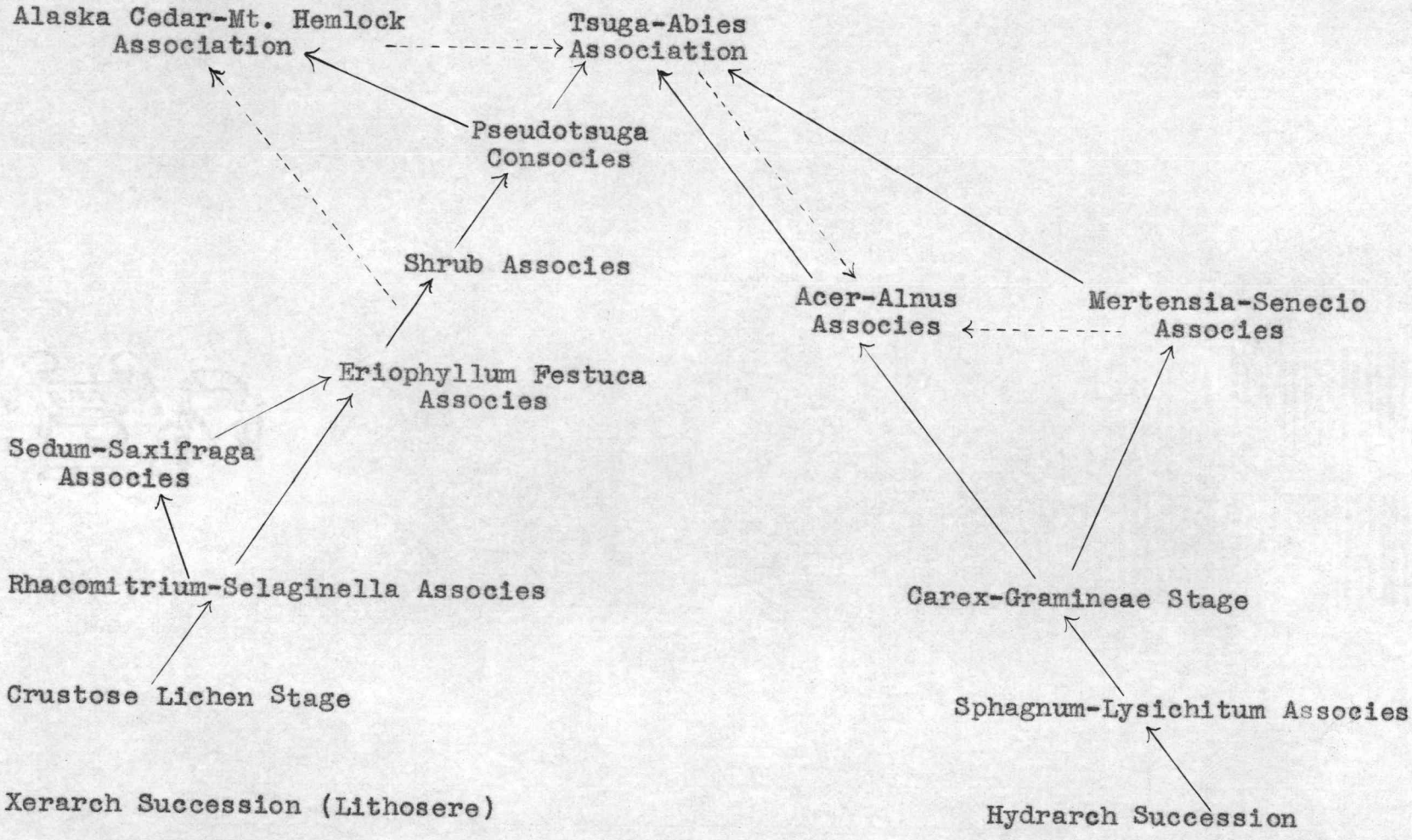


Fig. 10 Diagram of Successional Relationships

xerophytic community is an ecotone composed of more mesic herbs and certain shrubs such as Penstemon nemorosus, Lupinus latifolius var. subalpinus, Lilium columbianum, Xerophyllum tenax, Rhododendron macrophyllum, Vaccinium membranaceum, Berberis nervosa and Amelanchier florida. Beyond the shrub ecotone is the forest with the more xerophytic Douglas fir encountered first followed by Tsuga heterophylla, one of the climax dominants. (See figure 10) Xerarch succession follows essentially the same pattern at the summit of New Monument but with a few irregularities. Alaska cedar (Chamaecyparis nootkatensis) (Lamb.) Spach. and mountain hemlock (Tsuga Mertensiana) (Bong.) Sang. although rare, constitute a small association. The latter is undoubtedly at the extreme lower limits of its altitudinal range in this area, while Alaska cedar apparently is a relict of a population that was formerly more extensive in this region earlier in postglacial time.

In the second place, the climax dominant of greatest abundance is Abies procera instead of western hemlock. In the third place, western white pine (Pinus monticola) and Holodiscus discolor (Pursh.) Maxim. are two common species found in the ecotone between the rock-fell community and the climax forest.

Fig. 11 The Noble Fir Consociation near the Summit of New Monument

Fig. 12 The Noble Fir Consociation as it meets the Alder-Maple Associes at 4300'

The Abies procera Consociation

Bordering the rock-fell community is a forest band consisting of a nearly pure stand of Noble fir. The vertical extent of this forest is approximately 300 feet beginning at about 4300 feet and disappearing at roughly 4600 feet. Its upper limit is controlled by edaphic factors and where the latter are favorable, as near both summits, Noble fir reaches to nearly 4700 feet. The north slope of East Ridge is too precipitous to support any tree growth above 4400 feet. Below that elevation a mixed stand of young trees occurs, probably representing the new growth which followed the disastrous Rock Creek fire. North Ridge was not studied in detail but the Noble fir there too is confined largely to elevations below 4500 feet because of the physiographic factors. The north slope of West Ridge supports a rather large stand of even growth Abies procera.

The trees in this community are typically so close together as to make the forest floor very dark. Consequently there are very few associated species. A shrub layer is entirely absent except where an opening in the canopy occurs. Two ericads, Chimaphila Menziesii (R. Br.) Spreng., and Pleuricospora fimbriolata Gray, the latter almost entirely hypogeous, together with Asarum caudatum Lindl. are found in the dense forest; while Pyrola dentata Smith, Collinsia grandiflora Dougl., Symphoricarpos mollis

Nutt., Smilacina sessilifolia Nutt., Clintonia uniflora Kunth, Anemone deltoidea Hook., Polemonium carneum Gray, Rosa gymnocarpa Nutt., Ribes viscosissimum Pursh, and Rubus parviflorus Nutt. are typical species along the margins and in small clearings. Pleuricospora fimbriolata has a very high fidelity for this habitat. It may be said to be an exclusive for the dark floor of the Noble fir consociation.

There can be little doubt that Abies procera is climax in this area. Hanzlick (20, p.929-934) who made a study of Noble fir near Palmer, Oregon, found that this species is one of the main components of the forest on the west slope of the Cascade Range in Washington and Oregon between 3000 and 5000 feet. It is a tree of intermediate tolerance, (6, p.234) similar in this character to Douglas fir but less tolerant than Tsuga heterophylla and Thuja plicata. It rarely occurs in pure stands although there formerly existed in Washington and Oregon rather extensive areas consisting predominantly of large trees of this species. However, these have been almost entirely removed by lumbering operations.

Increment cores from thirteen specimens near the first switchback were taken to determine the age of the stand.

The results are tabulated below.

Specimen No.	D.B.H.* in inches	No. of rings	Specimen No.	D.B.H. in inches	No. of rings
1	5.5	36	8	13.5	41
2	6.5	36	9	7.5	41
3	7.5	36	10	3.5	20
4	5.3	36	11	---	35
5	7.5	36	12	---	27
6	5.0	30	13	---	28
7	12.0	40			

* Diameter breast high

Specimens No. 7, 8, 9, and 10 were all located at the margin of the woods, while Nos. 1 to 6 inclusive grew well within the forest. No. 8 shows asymmetrical trunk growth internally; the radius on the side next to the forest measured 6.5", while the radius on the side next to the clearing where more light was received measured 7". Specimens 11 and 12 were located at the lower margin of the Noble fir forest immediately adjacent to the alder-maple community while No. 13 grew thirty yards inside the fir forest.

Hanzlick found that on an average, Noble fir seedlings require ten years to reach a height of four feet (20, p.931). Since the increment cores were taken at approximately four feet above the ground, it is necessary to add an average of ten years to the ring number to determine the actual age of the tree. It will be noted that specimens 7, 8, and 9 which grew at the margin of the woods with less competition

for light, had a slightly greater number of growth rings at the four feet level than did the others. If it be assumed that they grew faster than the specimens sampled farther in the forest, it follows that they would reach a height of four feet in less than ten years. In view of the fact that Noble fir produces a good crop of seed only once in several years, it seems reasonable to conclude from the above deductions that all the trees sampled, with the exception of No. 10, are the same age class and that they are approximately 46 or 47 years' old. The last major fire on the south slope of Monument Peak could have occurred no later than 1901 or 1902 and probably earlier since a good seed year might not necessarily have followed the fire immediately. This conclusion agrees with the word of Mr. L. T. Henness who stated that the so-called Rock Creek fire which started southeast of Old Monument and moved west and northwest occurred approximately 1900.

Along the lower margin of the Abies procera consociation where the latter meets the Acer-Alnus community the vegetation exhibits an alterne. There simply is no transition zone present.

An effort was made to see whether the boundary between these two adjacent communities is static or whether one community might be encroaching upon the other. The increment cores showed that the fir trees along the margin

next to the alder-maple community are the same age as those located further in the fir stand. A careful search revealed no seedlings of species of either community along the border. Furthermore, since all three species involved are only moderately tolerant, it is concluded that the border between the two communities is quite static. Along the upper margin of the Noble fir consociation where it meets the rock-fell community there is a narrow ecotone with Amelanchier florida and Holodiscus discolor as typical shrub species and with scattered specimens of western white pine and Douglas fir. The former find the ecotone region favorable because of the protection from the wind afforded by the forest combined with a greater amount of light. The two tree species are able to establish themselves on soil that is too rocky for Noble fir.

Evidence of the rather low tolerance of Noble fir is shown by the fact that although in the late summer of 1947 a good many current year seedlings still displaying their cotyledons were noted on the forest floor, they had entirely disappeared by the summer of 1948. It is therefore to be expected that few new stands of Noble fir will be found in the forest unless clearings are made by natural or other means.

Abies amabilis-Tsuga heterophylla Faciation

This community reaches its best development on the southwest slope of New Monument between 4000 and 4400 feet. The hemlock trees outnumber the firs nearly three to one and average somewhat larger with many individuals attaining a trunk diameter of from three to four feet, while very large specimens of *Abies amabilis* do occur but are rare.

There is evidence of some reproduction by both species. Because of the open canopy there exist three rather distinct though discontinuous layer societies. They are the tall shrub layer consisting of *Acer circinatum* and *Sambucus callicarpa*; the low shrub layer composed of *Ribes lacustre*, R. *viscosissimum*, *Rosa gymnocarpa* and *Rubus parviflorus* (the last species is especially abundant in the clearings); and the herbaceous layer. A list of species found in the last society is given below.

Pteridium aquilinum var. lanuginosum
Polystichum munitum
Melica Smithii
Melica subulata
Trillium ovatum
Luzula parviflorus
Smilacina sessilifolia
Streptopus amplexifolius
Oxalis oregana
Cornus canadensis
Montia sibirica
Achlys triphylla
Galium triflorum
Galium oregana
Viola glabella
Tiarella unifoliata
Epilobium angustifolium
Thalictrum occidentale
Anemone deltoidea
Asarum caudatum
Dicentra formosa
Valeriana sitchensis
Hydrophyllum tenuipes

Abies procera-Abies amabilis Faciation

At about 4300' the hemlock disappears and its place is taken by Noble fir. This division of the association differs from the previous one in that the forest floor is only sparsely covered with vegetation and by a slightly different floristic composition. Species in the Abies procera-Abies amabilis faciation not found in the Abies amabilis-Tsuga heterophylla faciation are as follows:

Xerophyllum tenax
Rubus lasiococcus
Pyrola dentata
Vaccinium membranaceum
Polemonium carneum
Symphoricarpos mollis

The soil throughout the Abies-Tsuga Association is medium to shallow with occasional exposed rocks. There is a considerable amount of humus in the A-horizon and the soil gives evidence of being quite fertile.

The Pseudotsuga taxifolia Consocies

Douglas fir spreads over the north, west, and south slopes of West Hill and extends as a narrow interrupted corridor up the rise to the summit of New Monument. Owing to its more xeric character this tree has been able to establish itself on the soil that is too dry and rocky for hemlock and true fir. Below 4000' where it occurs as a nearly pure stand made up of medium-sized trees, there is evidence that the absence of the hemlock is temporary and

can be attributed to rather recent fires. Oxalis oregana creates an aspect society on the forest floor on the west slope between 3600 and 4000 feet. Vancouveria hexandra (Hook.) Morr. & Dene. is apparently restricted to this locality as it was not found anywhere else on the mountain.

The Acer-Alnus Associes

This community is confined to a moderate southwest slope characterized by an abundance of soil moisture over most of the area. The soil itself is rather shallow with a considerable quantity of rock fragments below 10 or 12 inches. The presence of this shrub community poses an interesting problem replacing the Noble fir consociation as it does so abruptly at about 4300 feet altitude, and extending down to the bottom of Rock Creek canyon. Soil differences in the two communities are not significant although the depth of the soil in the fir forest averages a little greater. The explanation is not to be found in the parent rock underlying the two communities, for examination of rock samples showed them to be identical.

According to Mr. L. T. Henness the maple-alder stand occupied approximately its present position when he saw the area the first time in 1864. Ring growth counts showed the average age of the alders sampled to be between 50 and 55 years with one specimen reaching the age of 70.

Fig. 12a The Alder-Maple Associes
from a Ridge

Fig. 12b The Alder-Maple Associes
from near Cabin

The maples averaged just slightly younger although the small difference might easily be explained in the method of sampling. Cores were taken as near the base of the trees as possible, but owing to the prostrate position of the trunks, the actual height above the root at which the samples were taken varied somewhat. In many cases as much as four to eight feet of the basal portion of the trunks of both maples and alders are absolutely prone with part of the trunk buried in duff. It is not unusual to find branching occurring in the horizontal portion of the main stem. The prone trunks invariably head down the slope which would indicate that soil creep is a factor in initiating this peculiar growth habit, but it is likely that the heavy snow pack, which probably reaches to depths of eight to ten feet, is the chief cause.

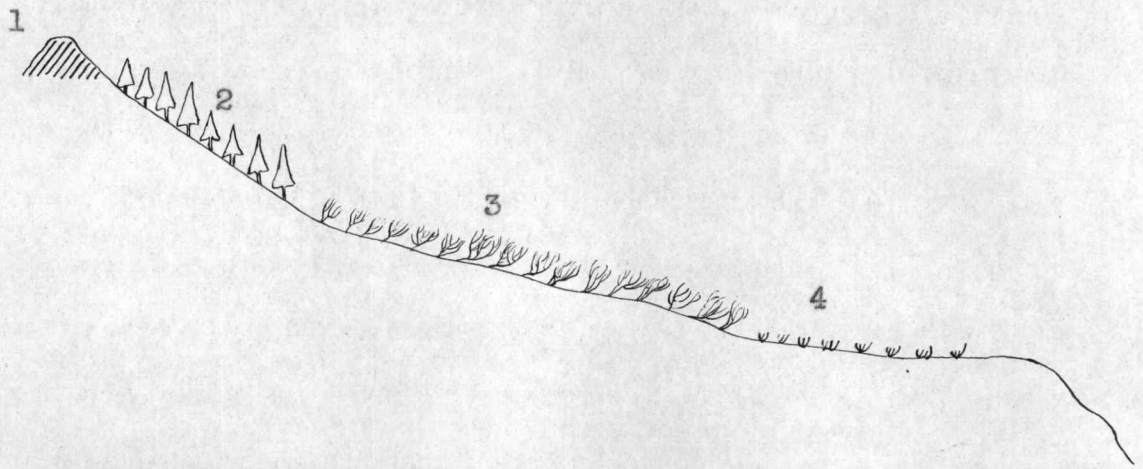
Only one snag, presumably an old conifer, whitened with age, is found in the entire associes, which would indicate that if the area ever supported a coniferous forest it was sometime in the rather remote past. There is no evidence of fire's having disturbed the area.

This community apparently is a favorite habitat for Aplodontia rufa rufa, the mountain beaver. Its tunnels and burrows are very numerous. Evidence of co-action between this rodent and the vegetation as a factor in the occurrence of two distinct, but contiguous and stable

communities was sought but with no positive results. The mountain beaver is purely a vegetarian with a wide range of food plants. Although especially favoring ferns, vetch, and certain lilies, he will eat willows, alders, maples, thimbleberries, salmonberries, and in fact most of the shrubs. The coast subspecies sometimes cuts limbs from hemlock and cedar presumably for food, but Bailey reports that although he examined large numbers of colonies he did not find "where any number of young or larger trees had been injured by them" (4, p.225-229). The existence of the alder-maple community is to be explained on the basis of several factors. First, the terraine occupied by this stand is on the whole less steep than the adjacent slope covered with Noble fir. Again, the soil moisture content during the growing season is higher, owing to seepage, except for islands with drier soil that support only herbs. The stand of vegetation is so dense that it is hardly conceivable that even a highly tolerant conifer seedling could exist.

A profile of the southwest slope from the top of east ridge to 4000' is shown in figure 13. Presumably the area now occupied by the alders and maples at one time supported a coniferous forest which was wiped out by some disturbance, probably fire. During the period of occupancy by the coniferous forest, more soil was accumulating and

soil moisture conditions were improving. When the conifers were removed, alder and maple became established and it seems likely that they may hold the area against invaders until the habitat becomes more xeric through better drainage.



1. Rock-fell community
2. Noble fir consociation
3. Alder-maple associes
4. Marsh-bog community

Fig. 13 Profile of the South Slope of East Ridge

Alder is to be found in the wetter portions of the community, especially along the stream banks; however, maple and alder occur together in much of the area. In still other parts of the community maple is present without alder forming a consocies. The typical associate species of alder when the latter occurs without maple are: Athyrium Filix-femina (L.) Roth., Trillium ovatum Pursh, Smilacina sessilifolia (Baker) Nutt., Streptopus

amplexifolius (L.) DC., Montia sibirica L., Dicentra formosa (Andr. DC.), Tolmiea Menziesii (Pursh) T. & G., and Viola glabella Nutt. Typical plants in the Acer circinatum consocies are Hydrophyllum tenuipes Hel. and Actaea arguta Nutt. Thus it is seen that the associate species differ noticeably in the two consocies.

Three rather well-defined layer societies are found in this community. The first, which may be designated as the tall shrub synusia, consists principally of the two seral dominants, Alnus sinuata and Acer circinatum with Salix sitchensis and Prunus emarginata (Dougl.) Walp var. erecta (Presl.) Piper occasionally present.

The second synusia or lower shrub society may include all or nearly all of the following:

Sambucus callicarpa
Rubus spectabilis
Oplopanax horridum
Ribes bracteosum

A tall herbaceous stratum most marked in the clearings during the latter half of the growing season is composed of the following species:

Senecio triangularis
Mertensia paniculata borealis
Heracleum lanatum
Thalictrum occidentale
Stachys ciliata
Rudbeckia occidentalis
Actaea arguta

A low herb synusia is easily discernable with the following species typical:

Viola glabella
Synthyris reniformis
Montia sibirica
Tolmiea Menziesii
Smilacina sessilifolia
Carex festivella
Rumex Acetosella
Luzula campestris
Disporum oreganum
Boykinia major
Osmorhiza nuda
Stachys rigidia
Achillea lanulosa

The Bog-Marsh Community

At approximately 4000 feet elevation at the base of a southwest slope just below an arm of the alder-maple community and immediately adjacent to the latter is an area characterized by soil that is nearly to entirely saturated throughout the growing season. Its lower margin is set off by a small stream, a tributary of Rock Creek, along which is a sprinkling of conifers, mostly Abies amabilis and A. procera. The entire area averages approximately 50 yards long. At an altitude of about 4400 feet on a west slope along the trail to the summit of Old Monument is a very small bog with a few species not found in the larger one. Likewise on the south slope of New Monument at above 4300 feet, there occurs a very small marshy area which contributes four or five additional species of typical marsh plants. Since these two very small areas are essentially similar to the larger bog, their flora will be considered along with that of the main bog.

Fig. 14 The Bog-Marsh Community at 4000'

Hydrarch succession is occurring in the bog community although the seral stages are not sharply differentiated. Reference to figure 10 will show the successional trends with the various seral dominants.

Growing partially or wholly submerged is Cardamine Breweri Wats. var. orbicularis (Greene) Detl. Other of the most important hydrophytic species are Lysichitum americanum St. John, Scirpus Congdoni Britt., S. microcarpus, Sphagnum Spp., Habernaria leucostachys (Lindl.) Wats., Montia cordifolia (Wats.) Pax. & Hoffm., Ranunculus Populago Greene, Caltha biflora DC., Parnassia fimbriata Konig., Hypericum anagalloides C. & S., Epilobium glandulosum Lehm., Veronica americana (Raf.) Schwein., Mimulus moschatus Dougl., and Galium cymosum Wieg.

In the more mesic zones of the marsh, certain species of grasses and sedges predominate; not, however, to the exclusion of certain forbs. The following list represents the most characteristic species.

Glyceria leptostachya
Glyceria elata
Pleuropogon refractus
Calamagrostis canadensis
Agrostis Thurberiana
Carex Mertensii
Carex Kelloggii
Carex festivella
Habenaria saccata
Montia sibirica
Achillea lanulosa
Aconitum Howellii
Thalictrum occidentalis
Spiraea densiflora
Viola Macloskeyi
Osmorhiza occidentalis
Heracleum lanatum
Vaccinium ovalifolium
Veronica humifusa
Arnica latifolia
Senecio triangularis

The Tsuga Mertensiana-Chamaecyparis Association

At the summit of New Monument on a northeast slope are a few specimens each of Alaska cedar (Chamaecyparis nootkatensis) and Tsuga Mertensiana constituting what may be regarded as a very small association. No large specimens are to be found of either species at the summit. However, on a south slope a little below 4400' near the margin of the alder-maple community are three clumps of trees two of which are known to be Alaska cedar while the third although composed entirely of dead specimens is presumably made up of this species also. The three clumps are in a rather straight line with no more than 150 feet separating adjacent groups. The size of the individual trees in the three groups ranges from approximately 15 inches to a little more than four feet in diameter with the large trees predominating in numbers. Diameter measurements were made at approximately four feet above the ground. In the clump of dead trees one trunk has a diameter of 30.6 inches. One group was singled out for special study. In this clump 12 distinct trunks are arranged in three subgroups with eight in one and two each in the others. The eight trunks of the first subgroup all arise from what appears to a common woody base with from only eight inches to two feet separating adjacent trees.

Fig. 15 Clump of Alaska Cedars

Fig. 16 Close-up of the Same Clump
as shown in Fig. 15

The trees in the other two subgroups likewise arise from woody bases which may or may not be a part of the larger base from which the eight trees grow. These four trees stand within two to four feet from some of the other eight. The outermost tree of the clump on the up slope side is dead and displays a long fire scar. Increment cores were taken from this specimen and from four other trees in the clump to determine their ages. Reference to the table below will show the results. It will be noticed that in only one case, namely that of the dead tree, was the core obtained equal to the radius of the tree bole. Hence it was impossible to obtain the exact age of the four living trees from which cores were taken. However, the total age was estimated as follows: the length of the core obtained was subtracted from the computed radius and the number of rings which probably would have been found in the unsampled part of the tree was added to the number of rings actually counted in the core. To this total an arbitrary figure of ten was added to allow for the time involved into the seedling's reaching four feet in height. In estimating the number of rings in the unsampled portion of the tree, the number of rings per inch in the proximal two inches of the core minus two was used to allow for the greater width of annual rings usually found near the center of the tree.

Specimen No.	Computed D.B.H.	Computed radius	Length of core	No. of annual rings in core	Total age (est.)
1[a]	14-1/3"	7-1/6"	9-2/8"	140	150
2	32-1/2"	16-1/4"	12-3/8"	260	311
3	30"	15"	11-5/8"	156	180
4	50"	25"	12-1/8"	164	225
5	34"	No core taken.			

[a] Dead tree, core exceeded radius

The huge woody base referred to above from which the trees in the clump arise presents an interesting problem. Typically, the boles of Alaska cedars exhibit broad, buttressed, and often fluted bases (22, p.222-224). One possible explanation is that this woody base represents a fusion or coalescence of the bases of several trunks. However, this does not appear to be the case. An alternative explanation is that this is an instance of suckering from a single parent tree that was destroyed by mechanical injury. According to the literature, however, suckering is not known to occur in this species. In fact this phenomenon in the conifers is supposedly limited to the genus, Sequoia.

THE GEOGRAPHICAL AFFINITIES OF THE FLORA

The vascular flora of that part of Monument Peak included in this study comprises 280 species and varieties of which 261 are indigenous. The affinities of some of these species are quite clear while with others the relationships cannot be definitely established with our present information.

The floras of the northern regions of North America and Eurasia have received a great deal of attention by such students of phytogeography as Fernald, Hulten, Raup, Porsild, Griggs, and a host of others. As a result of these studies and of information contributed by geologists of Pleistocene glaciation, considerable is known about the boreal elements of our flora. It is possible to list certain species as being quite positively of northern origin. It is held that most of our Alpine and Hudsonian species even though they may occur as far south as the mountains of California are of boreal origin. Typical centers of dispersal for these boreal species have been mapped by Hulten (27, p.22, 25). Some of these occur in far northern areas which escaped the ice during maximum Pleistocene glaciation, while others are located along the southern boundary of the ice.

The interglacial periods may have been as significant as the period of maximum glaciation. Hulten (27, p.141)

says that during these hot dry periods many plants were able to persist only on moist alpine summits. They suffered a depauperation of their biotypes and became rigid species, that is, species which no longer have the capacity of widening their area of distribution. This is very possibly the explanation for the range of certain species being restricted to mountain peaks in Oregon such as Allium cascadense on Monument Peak.

Evidence from paleontology and from the distribution pattern of many modern species points to the Mexican Plateau as a primary point of origin of many of our xerophytic species which occupy our deserts and semi-arid areas (42, p.20).

A third group of plants found in the semi-arid regions of Western North America today are undoubtedly indigenous to their present area, some having arisen as a "result of mutations in the surrounding mesophytic flora that produced species pre-adapted to the dry area" (42, p.21). Abrams (1, p.vi) would include this last group under his Great Basin Element which is believed to have developed east of the Cascade-Sierra Divide since the Glacial Period. This term suggests that the area is quite restricted in its northern extension which is probably not the case, as Daubenmire (42, p.21) holds that the dominant grass species of the Palouse country of Eastern Washington developed in their present area.

The Boreal Element

Of the 280 species and varieties found on Monument Peak above 3600', 91 are listed by Hulten (27) as being boreal. Raup (49, p.69, 80) adds two to the list, while Campbell and Wiggins (8, p.10-11) include five additional species, which makes a grand total of 98 or approximately 35 per cent of the total. Jones (30, p.49) lists 240 species (25 per cent of the total) from the Olympic Peninsula as constituting a northern element. However, the Olympic area embraces four life zones (Humid Transition, Canadian, Hudsonian, and Arctic-alpine) and a little more than a thousand species and varieties while the Monument Peak region represents essentially one life zone, the Canadian.

The Monument Peak species with boreal origins are listed below in four groups based on their supposed centers of radiation.

The West American Coast Radiants

The species comprising this group are believed to have had their center of dispersal in Southern Beringia and to have spread east and south. Sixty-three species from Monument Peak belong in this category.

Cryptogramma acrostichoides
Polystichum munitum
Tsuga heterophylla
Tsuga Mertensiana
Abies amabilis
Thuja plicata
Chamaecyparis nootkatensis
Melica subulata
Festuca subulata
Danthonia intermedia
Agrostis exarata
Elymus glaucus
Trisetum cernuum
Scirpus microcarpus
Carex Kelloggii
Carex laeviculmis
Carex Mertensii
Lysichitum americanum
Juncus ensifolius
Juncus Mentensianus
Clintonia uniflora
Disporum oreganum
Streptopus curvipes
Habenaria saccata
Salix sitchensis
Ranunculus orthorhynchus
Ranunculus uncinatus
  var. parviflorus
Caltha biflora
Anemone deltoidea
Aquilegia formosa
Saxifraga ferruginea
Saxifraga rufidula
Tiarella unifoliata
Parnassia fimbriata
Ribes bracteosum
Rubus spectabilis
Rubus parviflora
Fragaria platypetala
Potentilla gracilis
Sorbus sitchensis
Acer circinatum
Viola glabella
Epilobium glandulosum
Epilobium minutum
Oplopanax horridum
Heracleum lanatum
Cornus canadensis
Menziesia ferruginea
Vaccinium ovalifolium
Vaccinium membranaceum
Vaccinium parvifolium
Veronica americana
Mimulus guttatus
Collinsia parviflora
Collinsia grandiflora
Castilleja miniata
Sambucus callicarpa
Valeriana sitchensis
  var. Scouleri
Campanula Scouleri
Agoseris gracilens
Anaphalis margaritacea
Arnica latifolia
Senecio triangularis

The continental distribution of these 63 species is given below.

Cascade-Sierra Divide to the Pacific Ocean from Calif. to Alaska	45
Western Oregon Northward	7
Oregon Northward and across the middle Rocky Mts.	2
All of North America	3

Cascade-Sierra Range and the Atlantic Coast Region	1
Cascade-Sierra Range and the Blue Mts. of Oregon	1
Mts. of Western N. America	4

The 52 species comprising the first two categories have probably had a similar history of migration down the mountains of the Pacific Provinces and States. There are 69 other species represented on Monument Peak whose origins have not been postulated but whose ranges are very similar to those in the first category in the above list. It is likely that many of these have originated in Southern Beringia also.

The Continental West American Radiants

The species belonging to this group while present originally on the coasts of Beringia occur now mainly or exclusively inland in Alaska and Yukon and southward (27, p.75). Sixteen species from Monument Peak belong here. This is predominantly a group of wide continental distribution, eleven species being found in the Rocky Mountains, three reaching the east coast, thirteen ranging into California, and only one failing to get beyond the eastern boundary of Oregon.

Deschampsia elongata
Poa secunda
Carex Rossii
Smilacina sessilifolia
Silene Douglasii
Actaea arguta
Campe orthoceras
Erysimum asperum
Arabis Holboelii var. secunda
Ribes lacustre
Spiraea densiflora
Amelanchier florida
Vicia americana
Mertensia paniculata
Achillea lanulosa
Hieracium albiflorum

The Boreal Circumpolar Plants

It is believed that the species included in this category survived chiefly south of the ice during Pleistocene glaciation (27, p.120). They were not so depauperated of biotypes and did not lose their ability to spread. It is therefore not surprising to find 13 species of this group on Monument Peak, nine of which range over all of North America or at least the mountainous portions. Only three are limited to the Pacific States and Provinces.

Pteridium aquilinum
Equisetum arvense
Cinna latifolia
Festuca rubra
Luzula campestris
  var. multiflora
Rumex Acetosella
Polygonum Bistortoides
Trientalis latifolia
Arctostaphylos Uva-ursi
Epilobium angustifolium
Epilobium lactiflorum
Galium triflorum
Linnaea borealis
  var. americana

Vernonica humifusa is classed as an Arctic-Montane radiant having spread, it is believed, from the mountains of the Bering Sea area.

Other species with northern origins but whose centers of radiation are not known:

Alnus sinuata
Rhododendron macrophyllum
Symphoricarpos albus
Rubus parviflorus
Rosa gymnocarpa

The Eastern and Southern Elements

Too little is positively known about the centers of dispersal of the species whose present range is east and south of Central Oregon to warrant assigning them to definite categories based on origin. There are seven species on Monument whose range is from California to Oregon west of the Cascade-Sierra Divide. However, one would not be justified in assuming that these plants originated in California and migrated north. It is just as likely that they once ranged much farther north but have become exterminated in those areas by severe climatic conditions associated with Pleistocene glaciation. The seven species limited to California and Oregon are listed below.

Carex abrupta
Scirpus Congdoni
Lilium Washingtonianum
Aconitum Howellii
Thermopsis gracilis
Hydrophyllum occidentale
Erigeron Aliceae

There is a small group of species which on the basis of their present distribution could be regarded as an

eastern element since they are found typically east of the Cascade summit. Four of this group have been shown to be of boreal origin. Some of the remaining species could have originated in the area east of the Cascades as Daubenmire and Abrams suggest. But it is very likely that certain of them should be classed with Abram's Mexican element on the basis of origin as they are xerophytic and range principally southward on the east side of the Sierra-Cascade Range. Examples of this group are: Gayophytum humile which ranges into South America; Eriogonum compositum var. pilacaule, E. nudum, and E. umbellatum. The genus Eriogonum is apparently centered in the arid southwest as it is represented in California (mostly east of the Sierras) by 66 species, while only 10 extend into Southeast Washington. It is probable that some of the composites found on Monument Peak are likewise of southern origin.

Geographical Distribution of the Species Comprising the Present Flora of Monument Peak

Areas covered by known distribution	No. of species	Percentage of total flora
Pacific Region primarily west of Sierra-Cascades	121	43.0%
Pacific Region and Rocky Mts.	48	16.8%
Oregon Northward	42	16.0%
All North America	21	7.5%
Eastern Oregon and Eastward	8	2.9%
Oregon to California	7	2.5%
Limited to Oregon	6	2.14%
Pacific Region to North Central N. A.	6	2.14%
Northern North America	2	0.07%
Introduced from Various Regions	19	6.8%

The continental distribution of all the species on Monument Peak is given above. Although certain of the areas overlap, it is felt that there is justification for recognizing the ranges as given. For example, a species that is confined to the mountains of Western United States must have a narrower ecologic amplitude than one which is found not only in the Cascades and Rockies but also in the

upper Mississippi Valley, or it may have had a different geologic history.

It is significant that there are on Monument Peak six times as many species which range from Oregon northward through Washington or farther as there are forms which are limited to Oregon and California. Northwest Oregon has more in common climatically with the region to the north than it has with the area to the south. The climatic differences encountered in the region of the Rogue River evidently constitute a barrier to the north-south migration of certain species.

Adventives

Although the area is somewhat remote from human communities and the anthropeic factor has been negligible, 6.8 per cent of the species found on Monument Peak above 3600 feet are introduced. They comprise species from foreign sources (mostly European) which have entered within the period of historical record.

Only three monocotyledons all of which are grasses occur in the following list of adventives. Of the 16 dicotyledons, 15 are forbs and only one is a shrub, Cytisus scoparius, found in the cabin yard and probably purposely introduced by man very recently. The Compositae family with six species accounts for 31 per cent of the

total adventives. This high figure may be attributed, in part at least, to the efficient methods of seed dissemination which this family has developed and to the exceptional ability of many of the species to ecise readily.

Poa pratensis
Dactylis glomerata
Phleum pratense
Rumex Acetosella
Polygonum aviculare
Spergularia rubra
Cytisus scoparius
Trifolium repens
Trifolium pratense
Hypericum perforatum
Prunella vulgaris
Plantago major
Plantago lanceolata
Anthemis cotula
Cirsium arvense
Cirsium lanceolata
Taraxacum officinale
Hypochaeris radicata
Chrysanthemum Leucanthemum var. pinnatifidum

Relicts and Species with Discontinuous Distribution

Stellaria obtusa is found on the Olympic Peninsula but according to Jones (30, p.147) has not been reported from another station in Washington. Prior to this study it was reported in the literature to be limited to northeastern Oregon. Since Stellaria is regarded as a genus of northern origin, it is probable that S. obtusa is a relict species on Monument Peak, having migrated south because of the severe climate of Pleistocene glaciation. As the glaciers retreated this species has apparently been unable to withstand the competition of other plants under the warmer, drier conditions and has disappeared except in a few isolated refugia at rather high altitudes. The known

range of Chamaecyparis nootkatensis in Oregon is discontinuous on a relatively small scale. This species like Stellaria obtusa is of northern origin and is likewise to be regarded as a relict of former stands which during the period of Pleistocene glaciation extended into Northern California and were doubtless found at altitudes somewhat lower than at present. Of course, what has been said regarding the southward migration during the advance of the ice of these two species is true of many others except that in some cases as the ice receded and the climate ameliorated, the species retreated up the slopes and today are represented by extensive stands. An example of this is Noble fir. In other instances the species was entirely exterminated.

Until Allium cascadense was recently discovered in Southern Lane County by Mr. W. H. Baker (5) it should have been regarded as an endemic, for it appeared to be restricted in its range to a small area in Northeast Linn County; but this new station establishes it as a disjunct. Antennaria concolor ranging from Northern Linn County to Southwestern Washington should be regarded as a true endemic. One of the most striking cases of discontinuous distribution is a species of truffle, Hydnotrya variiformis known from only four localities, Monument Peak, Mary's Peak

in Benton County, Black Butte in Douglas County and Mt. Shasta, California (17, p.444).

Extensions of Range

Species	Direction of Extension	Former known Limits of Range
Melica Smithii	W	S.E. Washington and N. E. Oregon
Poa Canbyi	W	E. Washington and E. Oregon
Poa secunda	W	E. and S. Oregon
Carex festivella	W	Blue Mts. of Oregon
Scirpus Congdoni	N	Josephine Co. to McKenzie Pass
Allium cascadense	W	Jefferson Park, Linn Co.
Stellaria obtusa	W	N.E. Oregon and Olympic Peninsula
Erysimum asperum	W	East of Cascades
Arabis Holboelii var. secunda	W	E. slope of Cascades & E. California
Sedum divergens	W	E. slope of Cascades
Parnassia fimbriata	W	Blue Mts. of Oregon & Washington
Fragaria platypetala	W	E. slope of Cascades
Rosa Spaldingii	W	East of Cascade summit
Epilobium adenocaulon var. perplexans	W	E. Washington to E. California
Gayophytum humile	W	East slope of Cascades
Orogenia fusiformis	N	California and S. W. Oregon

Species	Direction of Extension	Former known Limits of Range
Mimulus Breweri	W	N.E. Oregon
Ranunculus Populago	N & W	Blue Mts. Cascades from Calif. to McKenzie Pass

Carex festivella according to the literature is restricted to the east slope of the Cascades except for a report from Southern Lane County in an unpublished manuscript by W. H. Baker.

Ranunculus Populago and Fragaria platypetala have both been collected (the former by the author) at Tombstone Prairie on the South Santiam Highway in Linn County. However, since this area for these species is not given in the floras of Oregon, their occurrence on Monument does actually represent an extension of range as far as the literature is concerned.

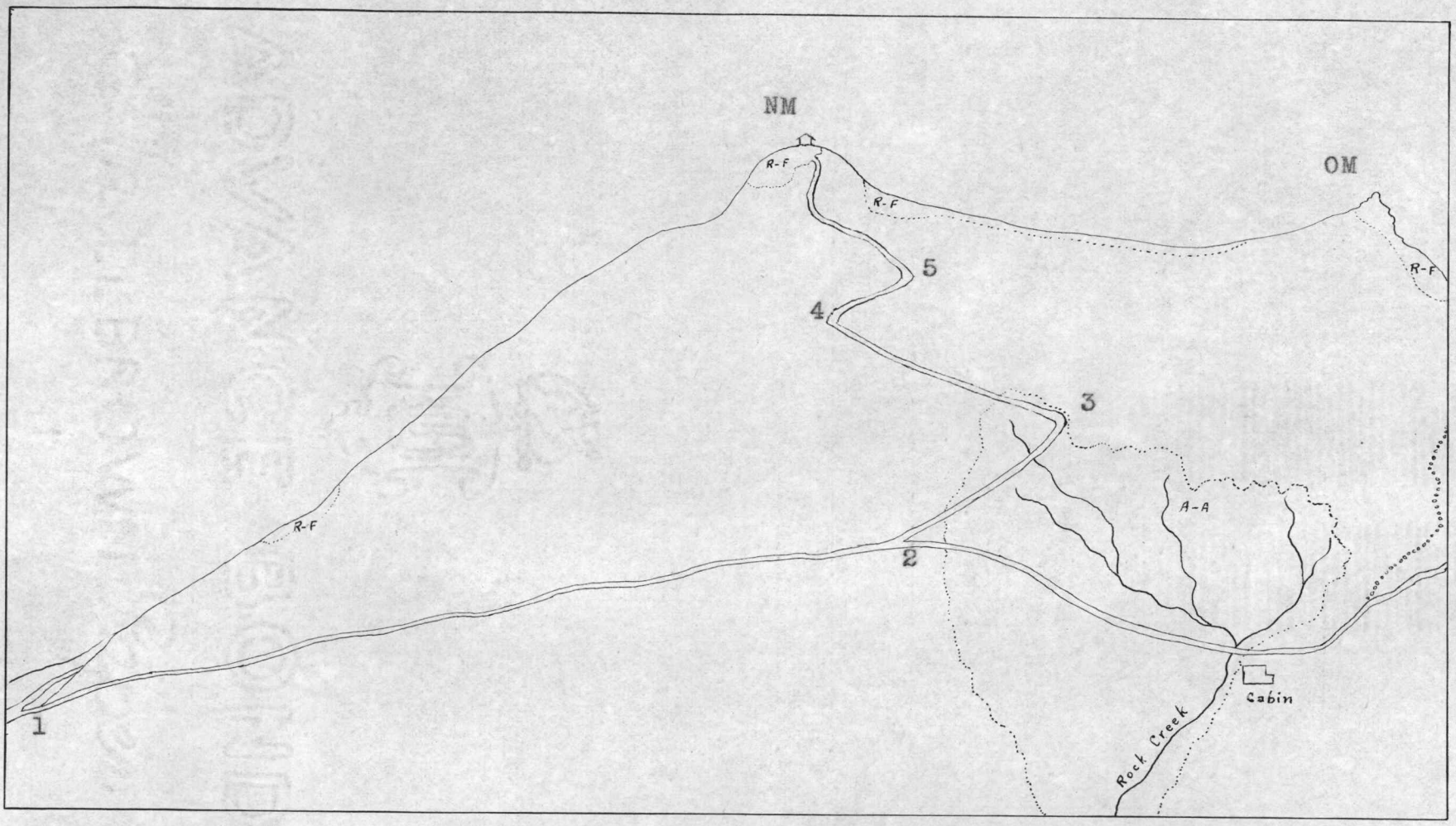
It is significant that of the 18 species whose known ranges have been extended by this study, in 16 cases the extension has been westward, that is, across the summit of the Cascade Mountains. This may mean one of three things. First, it can be assumed that these species are of polyphyletic origin evolving on opposite sides of the Cascade barrier. This hypothesis is however very unlikely since no morphological differences between the representatives from opposite sides of the mountains were detected.

A second explanation is that these species occurred over most of the state before the Cascades arose to their present height and are therefore very old. Such remarkable stability of species to make this hypothesis tenable is highly unlikely particularly in herbaceous forms. Therefore, this explanation is not offered as the solution.

The third possibility is that these particular species have not found the high mountain range to be an insurmountable barrier and therefore have migrated across in rather recent times. This hypothesis in the opinion of the author is the most feasible one of the three. It is proposed that the migration occurred during the dry period between 8000 and 4000 years ago since the Cascade Mountains probably presented a less formidable barrier then with less snow and a longer growing season near the summit than at present.

ANNOTATED CATALOGUE OF VASCULAR PLANTS WITH KEYS

The habitat, abundance, flowering time (when known) and the life form (according to Raunkiaer's system) is given for each species. Also the localities where each was collected together with the author's collection number are listed. The localities cited are intended to define the local distribution of each species. They are based for the most part on specimens collected and to a minor extent on field notes. The term "the summit" as here used refers to the area at the top of New Monument. The reader is referred to figure 17 for the specific localities cited in the species list. The abundance classification for the various species was arrived at from estimates except in the rock-fell community where the data from the quadrat studies were used. A further exception was in cases of very rare species where the classification was based on actual counts as recorded in field notes. It was the intention to give the abundance within a particular habitat rather than for the whole area unless the species occurred in several habitats in which case an average abundance in the various habitats considered collectively was given. Four abundance categories were used. "Very rare" was applied to a species where it was represented by no more than three specimens in the entire area or by a single colony composed of a very few individuals. This group was



1 2nd Road Fork
2 3rd Road Fork
3 1st Switchback
4 2nd Switchback
5 3rd Switchback
..... Trail
═══ Forest Road
A-A Acer-Alnus Associes
R-F Rock-Fell Community
NM New Monument
OM Old Monument

Fig. 17. Monument Peak Area from the Southwest

followed by a category termed "infrequent" and this one in turn by one designated "common." The term "very abundant" was reserved for those species which occurred in large numbers and were not confined to one habitat. As might be expected the number of species listed under "very rare" and "very abundant" is very small, since the great majority fall in the two intermediate groups.

The flowering times listed are necessarily approximate and can be expected to vary somewhat with the season and also with the altitude. For a more specific record of the period of blooming of the various species for the 1948 season the reader is referred to the Phenology Chart given elsewhere in this study.

The letters in parentheses following the flowering data indicate the life form to which each species belongs as found on Monument. The five categories as taken from Raunkiaer are as follows: phanerophyte (Ph), chamaephyte (Ch), hemicryptophyte (H), cryptophyte (Cr), and therophyte (Th).

The numbers in parentheses following the location data for each species are the numbers of the author's collections. Since only a relatively small amount of collecting has been done on Monument by other botanists, there are no citations to specimens other than to those from the author's own collections with one exception. This

is a Sorbus occidentalis (Wats) Greene collected by Dr. H. M. Gilkey and housed in the O.S.C. Herbarium. The author failed to observe this particular species; otherwise all the species listed in the catalogue which follows were found by the author.

ANALYTICAL KEY TO THE FAMILIES

Division I. PTERIDOPHYTA. Plants without seeds but reproducing by spores borne in sporangia. Ferns and their allies.

Plants with green leaves

Leaves very small, numerous, imbricated, radially arranged, several ranked, plant moss-like; spores of two kinds borne in strobili. 3. SELAGINELLACEAE.

Leaves relatively few and large bearing the sporangia, not imbricated nor several ranked; spores all of one kind. 1. POLYPODIACEAE...

Plants with leaves reduced to non-chlorophyll bearing toothed sheathes; stems usually hollow and conspicuously jointed 2. EQUISETACEAE....

Division II. SPERMATOPHYTES. Plants reproducing by seeds

Class I. GYMNOSPERMS. Trees or shrubs (ours evergreen) with needle-like or scale-like leaves; ovules and seed not enclosed in an ovary; stigma none.

Cone scales imbricated, each subtended by a bract; foliage leaves narrowly linear. 4. PINACEAE.....

Cone scales imperfectly or not at all imbricated, not subtended by bracts; leaves mostly very small, decurrent, and usually scale-like. 5. CUPRESSACEAE....

Class II. ANGIOSPERMS. Herbs, shrubs or trees, deciduous or evergreen, usually with broad leaves; ovules and seed enclosed in an ovary; stigmas one or more.

Subclass Monocotyledons. Fibrovascular bundles more or less scattered throughout the stem pith; leaves usually parallel veined; floral parts usually in 3's (rarely in 4's)

Inflorescence a spongy spadix surrounded by a colored spathe. 8. ARACEAE.....

Inflorescence not a spadix with a spathe.

Fruit a caryopsis or an akene; perianth parts inconspicuous or wanting; floral organs rarely regularly in 3's.

Stems hollow, cylindrical or flattened and distinctly jointed; stamens and pistil enclosed in a lemma and generally a palea, these (one or more) generally enclosed in glumes; anthers attached at middle. 6. GRAMINEAE.....

Stems solid more or less 3-angled and not distinctly jointed; stamens and pistil generally borne in the axil of a single bract; anthers attached at base. 7. CYPERACEAE....

Fruit a capsule or a berry; perianth parts well developed usually in two series; floral parts more commonly in 3's.

Ovary superior

Perianth parts scarious, small 9. JUNCACEAE.....

Perianth parts usually conspicuously colored and petaloid 10. LILIACEAE.....

Ovary inferior

Perianth regular; leaves equitant, stamens 3 11. IRIDACEAE.....

Perianth irregular; leaves not equitant, stamens 1 or 2 12. ORCHIDACEAE...

Subclass Dicotyledons. Fibrovascular bundles of the stem concentrically arranged about a central pith; leaves netted-veined; perianth parts usually in 4's or 5's

FLOWERS HYPOGYNOUS

Pistil or pistils apocarpous or slightly united at base

Carpels apparently 1

Corolla irregular (in ours), fruit a legume 29. LEGUMINOSAE...

Corolla regular or rarely wanting, fruit not a legume

Sepals 6, in 2 series or wanting 22. BERBERIDACEAE.

Sepals 3-5, often 4 21. RANUNCULACEAE.

Carpels 2 or more

Stamens 8-10; succulent plants 25. CRASSULACEAE..

Stamens many (sometimes only 10 in Ranunculus Lobbii); plants seldom succulent 21. RANUNCULACEAE.

Pistil syncarpous

Corolla wanting

Flowers in unisexual catkins; seeds with coma 13. SALICACEAE....

Flowers not in catkins, seeds without coma

Fruit an achene; herbs 18. POLYGONACEAE..

Fruit a pair of samaras; trees or shrubs 32. ACERACEAE.....

Corolla present
  Petals separate or only slightly united below or at the tip, not forming a distinct corolla tube

    Plants without green foliage 40. ERICACEAE.....
    Plants with green foliage
      Stamens numerous (more than 10)
                                  34. HYPERICACEAE.....
      Stamens 10 or fewer or if more with only 2 sepals
        Placentae parietal
          Petals 4, stamens 6 (occasionally 4 or 2)
            Inner pairs of petals with tips united; the outer pair sacate at base
                                  23. FUMARIACEAE.....
            None of the petals united or sacate
                                  24. CRUCIFERAE.....
          Petals 5, stamens 5   35. VIOLACEAE.....
        Placentae axial or basal
          Flowers with a glandular or fleshy floral disk borne on the receptacle
            Anthers opening by apical or basal pores or/and filaments dilated
                                  40. ERICACEAE.....
            Anthers not opening by pores; filaments not dilated
              Styles 2; fruit a pair of samaras
                                  32. ACERACEAE.....
              Style 1; fruit a capsule, follicle, or a berry-like drupe
                Stamens opposite the petals; seeds without an aril 33. RHAMNACEAE.....
                Stamens alternate with the petals (both opposite and alternate in Glossopetalon); seeds with an aril 31. CELASTRACEAE.....
          Flowers without a floral disk
            Ovary 1-loculed or incompletely 3 or 5 loculed; leaves simple
              Nodes usually swollen; sepals or calyx-lobes 4-5; capsule never circumscissle
                                  20. CARYOPHYLLACEAE..
              Nodes not swollen; sepals 2, or if more, the capsule circumscissile and the plant succulent 19. PORTULACACEAE....
            Ovary completely 5-lobed; leaves trifoliate
                                  30. OXALIDACEAE.....
  Petals united to form a cylindric to widely flaring or rotate corolla tube
    Corolla actinomorphic
      Stamens usually hypogynous, anthers opening by terminal pores 40. ERICACEAE.....

Stamens epipetalous
Stamens opposite the corolla lobes
41. PRIMULACEAE.....
Stamens alternate with corolla lobes
Calyx and corolla 4-lobed
48. PLANTAGINACEAE....
Calyx and corolla 5-lobed
Fruit a capsule
Styles 1, 3-(rarely 4-) cleft; placentae axial
42. POLEMONIACEAE.....

Styles 2, or 1 and 2-cleft; placentae parietal, 2
43. HYDROPHYLLACEAE...
Fruit 4 (rarely 2) nutlets
44. BORAGINACEAE.....
Corolla zygomorphic
Ovary with 2-4 parietal placentae; parasitic, without chlorophyll
47. OROBANCHACEAE.....

Ovary with an axial placenta; autophytic, possessing chlorophyll
Fruit a many-seeded capsule
46. SCROPHULARIACEAE..
Fruit 4 one-seeded nutlets
45. LABIATAE

FLOWERS PERIGYNOUS OR EPIGYNOUS

Corolla wanting
Trees and shrubs, diclinous or polygamous (occasionally monoclinous)
Leaves alternate, staminate flower in catkins or catkin-like spikes
Pistillate flowers in cylindric cone-like spikes, style 2-parted, involucre herbaceous
14. BETULACEAE.....
Pistillate flowers not in cone-like spikes, styles 3-6, involucre scaly, woody, or spiny
15. FAGACEAE.....
Leaves opposite, flowers never in catkins
Styles 1; fruit a berry or a drupe
39. CORNACEAE.....
Styles 2; fruit a samara
32. ACERACEAE.....
Plants herbaceous or woody only below
Stamens united with the style; ovary 6-loculed
17. ARISTOLOCHIACEAE..
Stamens not united with the style; ovary 1-4 loculed
Calyx-lobes petaloid; leaves alternate
16. SANTALACEAE.....
Calyx-lobes not petaloid; leaves opposite
39. CORNACEAE.....

Corolla present
  Petals separate or only slightly joined
    Stamens more than 10
      Calyx 5-cleft (rarely 3-8 cleft) 28. ROSACEAE.....
      Calyx 2-cleft; succulent annuals 19. PORTULACACEAE.
    Stamens 10 or fewer
      Calyx-tube not fused with the ovary the whole length of the latter
        Fruit follicular or pomaceous
          Shrubs 28. ROSACEAE.....
          Herbs 26. SAXIFRAGACEAE.
        Fruit neither follicular nor pomaceous
          Shrubs 33. RHAMNACEAE....
          Herbs
            Fruits akenes (sometimes enclosed in a fleshy structure) 28. ROSACEAE.....

            Fruit a capsule
              Calyx 5-lobed 26. SAXIFRAGACEAE.
              Calyx 2-lobed 19. PORTULAGACEAE.
      Calyx-tube fused with the ovary the full length of the latter
        Style 1, stamens (in ours) 2, 4, or 8
          Fruit a capsule or rarely nut-like; ovary typically 4-loculed 36. ONAGRACEAE....

          Fruit a drupe or berry; ovary 1-2-loculed 39. CORNACEAE.....
        Styles more than 1; stamens 5 (in ours)
          Fruit a schizocarp; style-bases often dilated 38. UMBELLIFERAE..
          Fruit a drupe or berry; style bases not dilated
            Ovary 1-loculed; placentae parietal 27. RIBESACEAE....
            Ovary 2-or more-loculed (in ours); placentae axile 37. ARALIACEAE....
  Petals united to form a distinct tube
    Fruit at maturity splitting into 2 nutlets or drupelets; leaves mostly whorled 49. RUBIACEAE.....
    Fruit not splitting into nutlets or drupelets; leaves alternate or opposite
      Fruit a capsule, drupe, or berry
        Leaves opposite 50. CAPRIFOLIACEAE
        Leaves alternate
          Corolla campanulate to rotate; stamens 3-5 52. CAMPANULACEAE.
          Corolla globose, oblong or urceolate, stamens 8 or 10 40. ERICACEAE.....

Fruit a nutlet or an akene
Stamens 1-4; flowers not in involucrate heads
54. VALERIANACEAE..
Stamens 5; flowers in involucrate heads
53. COMPOSITAE.....

DIVISION PTERIDOPHYTA

1. POLYPODIACEAE

Sori dorsal
Fronds jointed to the rhizome; indusia wanting
1. Polypodium
Fronds not jointed to the rhizome; indusia usually present
Fronds subcoriaceous, sori orbicular, indusia peltate
2. Polystichum
Fronds delicate, sori lunate, indusia attached along the inner edge
3. Athyrium
Sori marginal or submarginal
Fronds dimorphous (the fertile taller than the sterile)
4. Cryptogramma
Fronds all alike or nearly so
Pinnules usually minute, bead-like; sori rounded
5. Cheilanthes
Pinnules larger, not bead-like; sori linear
6. Pteridium

1. POLYPODIUM L.

1. P. vulgare L. var. occidentale Hook. On rocky ledges in exposed areas, infrequent (Cr)
Locs. On a west facing cliff behind cabin (955) and on a rocky ledge on North Ridge at 4500' (992).

2. POLYSTICHUM Roth.

1. P. munitum (Kaulf.) Presl. On open rocky slopes and in moist shaded areas, common. (H)
Locs. Southwest face of a rocky cliff at 4000' (870) and in Douglas fir forest on West Hill at 4000' (734).

3. ATHYRIUM Roth.

1. A. Filix-femina (L.) Roth In moist soil, typically in deciduous shrub thickets, common. (H)
Locs. In Alnus woods at 4300' (938 and 939); in bog margin at 4000' (896), and in deciduous woods at 4200' (873).

4. CRYPTOGRAMMA R. Br.

1. C. acrostichoides R. Br. On exposed rocky soil, infrequent. (H)
Locs. In rocky soil at the summit (584).

5. CHEILANTHES Swartz

1. C. gracillima D. C. Eaton In dry rocky soil on south and west exposures, infrequent. (H)
Locs. Open areas at the summit (588).

6. PTERIDIUM Scop.

1. P. aquilinum (L.) Kuhn. var. lanuginosum (Bong.) Fern. In open areas, common. (Cr)
Locs. On rocky open slope at 4000' (864) and in open woods (775).

2. EQUISETACEAE

1. EQUISETUM L.

1. arvense L. Moist clay soil, open areas, infrequent. (Cr)
Locs. In road ditch at 4400' (872).

3. SELAGINELLACEAE

1. SELAGINELLA Beauv.

1. S. Wallacei Hieron. Dry open areas on rocky soil, common. (Ch)
Locs. Southwest exposure at the summit (745) and on West Hill.

DIVISION SPERMATOPHYTA

CLASS GYMNOSPERMS

4. PINACEAE

Primary leaves scarious with fascicles of 2-5 (rarely 1) needle-like leaves in their axils; none of the leaves 2-ranked 1. Pinus

Without scarious leaves and fascicles; needles appearing more or less 2-ranked
Carpellate cones erect, their scales deciduous 2. Abies

Carpellate cones pendulous, their scales persistent
Bracts exserted beyond the cone scales; branchlets smooth; i.e. without woody persistent leaf bases
3. Pseudotsuga
Bracts not exserted; branchlets roughened by the woody persistent leaf bases 4. Tsuga

1. PINUS (Tourn.) L.

1. P. monticola Dougl. Edges of forest from 4000' to the summit typically in the ecotone between the Abies procera consociation and the rock-fell community; occurring singly rather than in stands, common. (Ph)
Locs. Near the cabin (683).

2. ABIES (Tourn.) Hill

Leaves flat; carpellate cone bracts shorter than the scales 1. A. amabilis

Leaves mostly 4-angled; carpellate cone bracts longer than the scales and exserted 2. A. procera

1. A. amabilis (Dougl.) Forbes. Occasionally occurring singly in open areas but principally in a forest associated with Tsuga heterophylla and less frequently with Abies procera. From 4000' to near the summit, common. (Ph)
Locs. At 4000' near cabin (993).

2. A. procera Rehd. Occasionally associated with Abies amabilis and Tsuga heterophylla but typically in dense pure stands, from 4000' to the summit, very abundant. (Ph)
Locs. At summit on east slope (694).

3. PSEUDOTSUGA Carr

1. P. taxifolia (Lambert) Britt. Typically at forest edge and in the ecotone between the forest and the rock-fell communities between 4000' and the summit. An important component of the forest at lower elevations particularly on the south and west slopes, common. (Ph)
Locs. On West Ridge at 4500' (848).

4. TSUGA (Endl.) Carr

Carpellate cones 2 - 2.5 cm. long, the scales 12 - 20
1. T. heterophylla

Carpellate cones 4 - 7 cm. long, the scales typically more than 20 2. T. Mertensiana

1. T. heterophylla (Raf.) Sarg. With Abies amabilis composing a forest mostly below 4400', common. (Ph)
   Locs. Near cabin (690).

2. T. Mertensiana (Bong.) Sarg. Associated with Abies procera mostly on east slopes from 4200' to the summit (very rarely at 4000'), infrequent. (Ph)
   Locs. Near cabin (679).

5. CUPRESSACEAE

Branchlets 2-ranked; ovulate cones eventually woody, the scales free
  Ovulate cones ovoid-oblong, scales imbricate 1. Thuja
  Ovulate cones globose, the scales peltate 2. Chamaecyparis
Branchlets not 2-ranked; ovulate cones pulpy and berry like, the scales fused 3. Juniperus

1. THUJA L.

1. T. plicata Donn. In woods associated with Douglas fir and western hemlock, infrequent above 3600'. (Ph)
   Locs. In a mixed conifer forest on logging road (898).

2. CHAMAECYPARIS Spach.

1. C. nootkatensis (Lamb.) Spach. Infrequent from 4000' to the summit, apparently wanting below those elevations. (Ph)
   Locs. Just below old lookout site (815) and at 4000' (680).

3. JUNIPERIS (Tourn.) L.

1. J. sibirica Burgsd. Confined almost entirely to the rocky southern and western exposures in the rock-fell communities, infrequent. (Ch)
   Locs. At the summit (693) on West Hill and East Ridge.

CLASS II ANGIOSPERMS

6. GRAMINEAE

Fertile spikelets pedicellate
  Spikelets 2- or more- flowered
    Glumes usually not equalling the lowest lemma; awn, if present, from the tip or a bifid apex
      I. FESTUCEAE
    Glumes equalling or exceeding the lowest lemma (except in Trisetum); lemmas commonly with a dorsal awn
      II. AVENEAE
  Spikelets typically 1-flowered (occasionally 2-flowered in Muhlenbergia)
    III. AGROSTIDEAE

Fertile spikelets sessile on the rachis
  IV. HORDEAE

I. FESTUCEAE

Leaf sheaths closed
  Glumes papery
    1. Melica
  Glumes not papery
    Glumes mostly 1-nerved; lemma usually obtuse, nerves parallel
      2. Glyceria

    Upper glume 3-5 nerved; lemma usually acute, nerves converging at apex
      3. Bromus
Leaf sheaths open on side opposite the blade
  Keels of the palea winged below; spikelets linear in an interrupted raceme
    4. Pleuropogon

  Keels of the palea not winged; spikelets paniculate
    Lemmas distinctly keeled dorsally (somewhat rounded in Poa scabrella and its allies)
      Spikelets strongly compressed in dense 1-sided fascicles
        5. Dactylis

      Spikelets not strongly compressed, not crowded in 1-sided fascicles
        6. Poa
    Lemmas scarcely keeled to rounded dorsally
      Lemma awnless, obtuse, with nerves parallel
        2. Glyceria
      Lemma with an apical point or awn, nerves converging
        7. Festuca

II. AVENEAE

Spikelets several-flowered, glumes 10-20 mm. long, the rachilla glabrous; cleistogenes present in the lower sheaths 8. Danthonia

Spikelets usually 2- (sometimes 3 to 5) flowered, glumes 2-8 mm. long, rachilla generally villous to hairy; cleistogenes wanting

Glumes commonly unequal falling with the spikelets; lemma keeled on the back 9. Trisetum

Glumes nearly equal, persistent, i.e. not falling with the spikelet; lemma rounded on the back 10. Deschampsia

III. AGROSTIDEAE

Rachilla disarticulating below the glumes, elongated between the glumes and the lemma to form a stipe 11. Cinna

Rachilla disarticulating above the glumes, not stiped below the floret

Glumes exceeding the lemma (only equalling it in some species of Agrostis)

Panicle spike-like, glumes compressed and the keel ciliate 12. Phleum

Panicle not spike-like, glumes not compressed nor keels ciliate

Callus with a tuft of hairs at least half as long as the lemma; rachilla usually prolonged behind the palea as a short bristle; palea present and normally developed 13. Calamagrostis

Callus-hairs wanting or if present rarely as much as half the length of the lemma; rachilla usually not prolonged; palea small or wanting 14. Agrostis

Glumes typically shorter than the lemma 15. Muhlenbergia

IV. HORDEAE

Only one genus in our locality 16. Elymus

1. MELICA L.

Culms definitely bulbous-dilated at base; lemmas awnless
1. M. subulata
Culms not definitely bulbous-dilated at base; lemmas distinctly awned
2. M. Smithii

1. M. subulata (Griseb.) Scribn. In moist clay soil on south slope, infrequent. (H)
   Locs. In Tsuga-Abies forest near the third road fork 4100' (964) and in clay bank near first switchback (944).
2. M. Smithii (Port.) Vas. In moist open woods, common. (H)
   Locs. In Tsuga-Abies forest near the third road fork 4100' (963 & 902).

2. GLYCERIA R. Br.

Spikelets linear, 10-15 mm. long — 1. G. leptostachya
Spikelets oblong-ovate, 3-5 mm. long — 2. G. elata

1. G. leptostachya Buckl. On stream bank and in a bog, infrequent. (H)
   Locs. Stream bank near cabin (972).
2. G. elata (Nash) Hitchc. In bogs and muddy soil from 4000' to 4400', infrequent. (H)
   Locs. Muddy soil in a thicket by first switchback (948) and in bog near cabin (937).

3. BROMUS L.

Spikelets 15-18-flowered; upper glume 3-nerved
1. B. vulgaris
Spikelets 10-12-flowered; upper glume 7-nerved
2. B. marginatus

1. B. vulgaris (Hook.) Shear. In open areas particularly where soil has been disturbed, common. (H)
   Locs. Along lookout road at 4200' (939) and near first switchback (954).

2. B. marginatus Nees. Roadsides in clay soil, common.
   Locs. Near first switchback (948).

4. PLEUROPOGON R. Br.

1. P. refractus (Gray) Benth. In a bog at 4000', infrequent. (H)
   Locs. In the bog across from cabin (940).

5. DACTYLIS L.

1. D. glomerata L. A single specimen in middle of road bed at 4600', very rare. Naturalized from Europe. (H)
   Locs. On forest road above third switchback (920).

6. POA L.

Lemma with a copious basal web — 1. P. pratensis
Lemma without a basal web
  Spikelets 5-7 mm. long; blades involute — 2. P. secunda
  Spikelets 7-10 mm. long; blades flat — 3. P. Canbyi

1. P. pratensis L. Moist meadows, very rare. (Cr)
   Naturalized from Europe.
   Locs. In cabin yard (957).

2. P. Canbyi (Scribn.) Piper. Open areas, rocky soil, infrequent, June to July. (Cr)
   Locs. At 4350' on a west slope (827).

3. P. secunda Presl. Dry rocky soil in open areas, infrequent, July. (H)
   Locs. In open area at the summit (927 & 929).

7. FESTUCA L.

Blades flat 5-10 (rarely 3) mm. wide; panicle 10-30 cm. long; lemmas somewhat keeled — 1. F. subulata

Blades usually folded or involute, 2.5 mm. wide or less; panicle 3-20 cm. long; lemmas rounded on back.
  Culms decumbent at the usually reddish fibrillose base; awn shorter than the body of the lemma — 2. F. rubra

  Culms erect, not reddish or fibrillose; awn as long as the body of the lemma or longer — 3. F. occidentalis

1. F. subulata Trin. Open woods in moist soil, infrequent, July to August. (H)
   Locs. Roadside near first switchback (945 & 946).

2. F. rubra L. Dry rocky soil in open areas, very abundant. (H)
   Locs. At the summit (932), and on West Hill.

8. DANTHONIA Lam. & DC.

1. D. intermedia Vas. In rocky soil in open areas, infrequent. (H)
   Locs. At the summit (925).

9. TRISETUM Pers.

Leaf blades typically pilose and canescent; glumes scarcely scarious 1. T. canescens

Leaf blades scabrous above and green; glumes with wide scarious margins or almost wholly scarious 2. T. cernuum

1. T. canescens Buckl. Open area, rocky soil, infrequent. (H)
   Locs. Summit (931).

2. T. cernuum Trin. Woods and forest margins in moist soil, common. (H)
   Locs. Edge of shrub thicket along lookout road at 4200' (854).

10. DESCHAMPSIA Beauv.

1. D. elongata (Hook.) Munro. In moist open meadows and open woods, common, July. (H)
   Locs. Cabin yard (965) and margin of shrub thicket at 4200' (951).

11. CINNA L.

1. C. latifolia (Trev.) Griseb. In moist open woods and thickets, infrequent, July to August. (H)
   Locs. Muddy thicket near first switchback (950).

12. PHLEUM L.

1. P. pratense L. In open area by side of road, very rare. Naturalized from Europe. (H)
   Locs. Roadside just below road fork at 4100' (934).

13. CALAMAGROSTIS Adans.

1. C. canadensis (Michx.) Beauv. Bogs, infrequent. (H)
   Locs. In a bog near cabin (888).

14. AGROSTIS L.

Leaf blades nearly smooth, 1-2 mm. wide; palea well-developed ..... 1. A. Thurberiana

Leaf blades scabrous above, 3-5 mm. wide; palea wanting or minute
  Plants with creeping rhizomes; palea wanting ..... 2. A. diegonesis
  Plants without rhizomes; palea present but 0.5 mm. long or less ..... 3. A. exarata

1. A. Thurberiana Hitchc. Bogs and stem banks, infrequent. (H)
   Locs. Shady stream bank near cabin (885) and in a bog (885).

2. A. diegoensis Vas. On dry rocky soil in open areas, common. (H)
   Locs. West Hill (908), also at summit (628).

3. A. exarata Trin. Open ground, south slopes, infrequent (H)
   Locs. Roadside 4100' (935) and near first switchback (919).

15. MUHLENBERGIA Schreb.

1. M. filiformis (Thrub.) Rydb. On clay soil along road on open south slope, infrequent. (Th)
   Locs. In road just below the third road fork at 4100' (952).

16. ELYMUS L.

1. E. glaucus Buckl. In moist meadows and open south-facing slopes with dry, rocky soil, common, July. (H)
   Locs. At the summit (926); also in cabin yard.

7. CYPERACEAE

Ovary completely enclosed by a sac-like bract (the perigynium) ..... 1. Carex

Ovary not enclosed by a perigynium; involucral bristles often present ..... 2. Scirpus

1. CAREX (Rupp.) L.

Stigmas 2
- Spikes long-cylindric, unisexual — 1. C. Kelloggii
- Spikes not long-cylindric, at least the terminal gynaecandrous
  - Inflorescence forming a dense ovoid head
    - All the bracts scale-like; spikes 4-8; perigynia ascending — 2. C. abrupta
    - Lowest bract prolonged; spikes 5-20; perigynia appressed — 3. C. festivella
  - Inflorescence interrupted, linear to oblong in outline, not forming a dense head
    - Perigynia distinctly nerved on both faces, the beak smooth or nearly so — 4. C. laeviculmis
    - Perigynia distinctly nerved on dorsal face only; the beak distinctly serrulate
      - Perigynia ascending, the body broadest near the middle; rootstocks long, old sheaths fibrillose — 5. C. leptopoda
      - Perigynia spreading, the body broadest near the base; root stocks short, old sheaths not fibrillose — 6. C. angustior

Stigmas 3
- Perigynia glabrous
  - Lower bracts with very short sheaths or none; perigynia ovate to orbicular in outline, margins entire, beak entire or emarginate — 7. C. Mertensii
  - Lower bracts with long sheaths; perigynia lanceolate in outline, margins serrulate, beak bidentulate — 8. C. ablata
- Perigynia pubescent
  - Some of the lower spikes basal; bract of lowest non-basal spike normally exceeding the inflorescence — 9. C. Rossii
  - None of the spikes basal; bracts undeveloped or the lowest equalling the inflorescence — 10. C. inops

1. C. Kelloggii W. Boott. Bogs, infrequent. (H)
Locs. In bog near the cabin (895).

2. C. abrupta Mack. Moist open slopes, very rare. (H)
Locs. Roadside at 4000' near cabin (868).

3. C. festivella Mack. Moist open woods especially in disturbed soil, common. (H)
Locs. Roadside just below summit (822) and on a clay bank near cabin (823).

4. C. laeviculmis Meinsh. Wet ground, open areas, infrequent. (H)
Locs. Roadside near first switchback (915).

5. C. leptopoda Mack. Moist open woods and thickets, common. (Cr)
Locs. South slope along lookout road at 4200' (862).

6. C. angustior Mack. Bogs, common. (H)
Locs. In the bog near the cabin (890).

7. C. Mertensii Prescott. Wet ground in open areas, common. (Cr)
Locs. Roadside near first switchback (824).

8. C. ablata Bailey. In bogs, infrequent. (Cr)
Locs. In the bog near the cabin (887).

9. C. Rossii Boott. In dry rocky soil, very rare. (Cr)
Locs. In open area at summit (916).

10. C. inops Bail. Dry open woods and exposed rocky slopes, common. (H)
Locs. Southwest slope at 4200' on lookout road (914) and on rocky soil, West Hill (913).

2. SCIRPUS (Tourn.) L.

Style branches 2; perianth bristles 4; culms 6-15 dm. high ..... 1. S. microcarpus

Style branches 3; perianth bristles 5-8; culms 2-5 dm. high ..... 2. S. Congdoni

1. S. microcarpus Presl. Confined to bogs and marshes, infrequent. (Cr)
Locs. In the bog near the cabin (897).

2. S. Congdoni Britt. Bogs, very rare, June to July. (Cr)
Not formerly known north of Mackenzie Pass in Oregon.
Locs. In bog near old cabin (814).

8. ARACEAE

1. LYSICHITUM Schoot.

1. L. americanum St. John. In bogs and marshy stream banks, infrequent. (Cr)
   Locs. Below the spring at 4400' (737) and in the bog near the cabin.

9. JUNACEAE

Capsule many-seeded; stems mostly pithy — 1. Juncus
Capsule 1-3-seeded; stems hollow — 2. Luzula

1. JUNCUS (Tourn.) L.

Inflorescence appearing lateral
  Perianth 6-7 mm. long; stamens 6; inflorescence 2-3 flowered — 1. J. Parryi

  Perianth 2-3 mm. long; stamens 3; inflorescence very many-flowered — 2. J. effusus var. pacificus

Inflorescence not appearing lateral
  Stamens 6; leaves completely septate, auriculate — 3. J. Mertensianus
  Stamens 3; leaves incompletely septate, auricles wanting — 4. J. ensifolius

1. J. Parryi Engelm. Dry rocky soil in open area with south exposure, infrequent. (H)
   Locs. At the summit (933).

2. J. effusus L. var. pacificus Fern. & Weig. In wet soil in open areas, common. (Cr)
   Locs. Roadside near spring at 4400' (635).

3. J. Mertensianus Bong. In open area on clay soil with southerly exposure, infrequent. (H)
   Locs. Roadside just below road fork, 4100' (806).

4. J. ensifolius Wiks. Along roadside in open area, common. (Cr)
   Locs. Roadside just above cabin.

2. LUZULA DC.

Panicle branches lax and drooping; perianth 1-2 mm. long — 1. L. parviflora

Panicle branches erect or nearly so; perianth 2.5 - 3.5 mm. long — 2. L. campestris var. multiflora

1. L. parviflora (Ehrh.) Desv. Moist ground in woods common. (H)
   Locs. North slope at 4500' (782) and in Tsuga-Abies forest at 4200' (875).

2. L. campestris (l.) DC. var. multiflora (Ehr.) Celak. In dry, rocky soil in open areas with southerly exposure, common. (H)
   Locs. West Hill (732) and along trail to old lookout at 4300' (825).

10. LILIACEAE

Fruit a capsule (fleshy and irregularly dehiscent in Trillium)
- Flowers in umbels, often head-like — 1. Allium
- Flowers not in umbels
  - Styles 3, separate
    - Leaves narrow, grass-like
      - Plants with bulbs — 2. Zigadenus
      - Plants without bulbs — 3. Xerophyllum
    - Leaves broad and large — 4. Veratrum
  - Styles 1 or if 3 united below
    - Sepals and petals similar
      - Leaves several to many; anthers versatile
        - Perianth funnelform, each division with a nectar gland at base — 5. Lilium
        - Perianth rotate, nectar glands wanting — 6. Camassia
      - Leaves 2, rarely 3; anthers not versatile — 7. Erythronium
    - Sepals unlike petals
      - Plants with bulb-like corms; leaves long and narrow, appearing basal — 8. Calochortus
      - Plants without corms; stem leaves 3, broad, not appearing basal — 9. Trillium

Fruit a berry
- Leaves all basal — 10. Clintonia
- Leaves not all basal
  - Flowers axillary; filaments flat; pedicels bent sharply near the middle — 11. Streptopus

Flowers terminal on the stem or branches; filaments not flat; pedicels not bent
  Flowers in terminal racemes or panicles
    12. Smilacina
  Flowers solitary or in a terminal umbel
    13. Disporum

1. ALLIUM (Tourn.) L.

1. A. cascadense Peck. In dry, rocky soil on exposed areas, common, June. (Cr)
   Locs. At summit (559 & 747).

2. ZIGADENUS Michx.

1. Z. venenosus Wats. In dry soil on open exposed slopes, infrequent, June to July. (Cr)
   Locs. At the summit (578).

3. XEROPHYLLUM Michx.

1. X. tenax (Pursh) Nutt. In moist open woods and meadows and in rather dry exposed areas, June to July, common. (H)
   Locs. Open woods along the forest road at 4000' (606).

4. VERATRUM (Tourn.) L.

1. V. viride Ait. Open woods in wet soil and stream banks, infrequent, August to September. (Cr)
   Locs. Woods near the cabin (666).

5. LILIUM L.

Perianth orange with maroon spots; capsule sharply 6-angled
  1. L. columbianum
Perianth white (drying pink) with purple spots; capsule not sharply 6-angled
  2. L. Washingtonianum

1. L. columbianum Hans. In open woods and along roadsides common, July to August. (Cr)
   Locs. Open woods (623).

2. L. Washingtonianum Kell. In thickets and meadows, infrequent, July to August. (Cr)
   Locs. Near summit at forest margin (626).

6. CAMASSIA Lindl.

Perianth slightly irregular; divisions twisting separately in withering 1. C. Quamash

Perianth regular, divisions twisting together in withering 2. C. Leichtlinii

1. C. Quamash (Pursh.) Wats. In moist meadows very rare, July. (Cr)
   Locs. In cabin yard (880).

2. C. Leichtlinii (Baker) Wats. In moist soil in open meadows, very rare, July. (Cr)
   Locs. In cabin yard (884).

7. ERYTHRONIUM L.

Filaments of the longer stamens conspicuously widened and flattened below the middle; leaves usually mottled; perianth typically pale cream 1. E. oregonum

Filaments scarcely to not at all widened; leaves not mottled; perianth white or bright yellow.
  Leaves broadly oblong to ovate typically narrowing abruptly at base; perianth white 2. E. montanum

  Leaves oblong to oblanceolate not narrowing abruptly at base; perianth bright yellow 3. E. grandiflorum var. pallidum

1. E. oregonum App. In meadows, open woods and exposed grassy slopes, May to July, common. (Cr)
   Locs. Dry slope of "saw log hill" 3700' (729) also on west slope just below the summit.

2. E. montanum S. Wats. Open woods and shade infrequent, June to July. (Cr)
   Locs. Shady stream bank near cabin (753), open woods 4000' (818).

3. E. grandiflorum Pursh. var. pallidum St. John Rocky soil on exposed westerly slopes; infrequent, June. (Cr)
   Locs. Open area at summit (738).

8. CALOCHORTUS Pursh.

1. C. Lobbii Baker. In rocky soil on southwesterly exposure, infrequent, June to August. (Cr)
   Locs. Grassy slope at the summit (570).

9. TRILLIUM L.

1. T. ovatum Pursh. Moist open woods apparently not exceeding 4000' in altitude, infrequent, May to July. (Cr)
   Locs. Open woods at base of forest road (723).

10. CLINTONIA Raf.

1. C. uniflora (Schult.) Kunth. Open woods in moist soil, infrequent, July. (Cr)
   Locs. Open woods, just above third road fork (566).

11. STREPTOPUS Michx.

Stem simple; perianth whitish with purple spots — 1. S. curvipes
Stem usually branched; perianth yellowish green — 2. S. amplexifolius

1. S. curvipes Vaill. In moist woods, very rare, July. (Cr)
   Locs. In shaded area, near old cabin (809).

2. S. amplexifolius (L.) DC. Open woods in damp soil, infrequent, July. (Cr)
   Locs. Open woods, south slope near first switchback (810).

12. SMILACINA Desf.

Flowers numerous, paniculate — 1. S. racemosa
Flowers few, racemose — 2. S. sessilifolia

1. S. racemosa (L.) Desf. In open woods on damp soil, common, June to July. (Cr)
   Locs. Open woods (609) and roadside 100 yards below first switchback (803).

2. S. sessilifolia (Baker) Nutt. At the margins of shrub thickets infrequent, June to July. (Cr)
   Locs. Below third road fork half way to cabin (757).

13. DISPORUM Salisb.

1. D. oreganum (Wats.) B. & H. On moist soil in shrub thicket, infrequent, June. (Cr)
   Locs. In shaded thicket near third road fork (771).

11. IRIDACEAE

Style branches petaloid; petals and sepals unlike
1. Iris
Style branches not petaloid; petals and sepals similar
2. Sisyrinchium

1. IRIS (Tourn.) L.

1. Iris tenax Dougl. In woods, very rare at 4000' and above (common below 3000') August. (Cr)
Locs. In deep shade near cabin (970).

2. SISYRINCHIUM L.

1. S. idahoense Bickn. In grassy meadows, infrequent, July. (H)
Locs. In cabin yard (613).

12. ORCHIDACEAE

1. HABENARIA Willd.

Perianth greenish, spur much shorter than the tip
1. H. saccata
Perianth white, spur longer than the tip
2. H. leucostachys

1. H. saccata Greene. In open grassy areas and in bogs, infrequent, July to August. (Cr)
Locs. Open area at the summit (580).

2. H. leucostachys (Lindl.) Wats. In bogs and along stream banks, common, July to August.
Locs. In the bog near the cabin (688).

13. SALICACEAE

1. SALIX (Tourn.) L.

1. S. sitchensis Sans. In deciduous woods, south slopes, June, infrequent. (Ph)
Locs. Roadside, 4100' (764).

14. BETULACEAE

1. ALNUS Hill

1. A. sinuata (Regel) Rydb. On moist soil, very abundant, constituting a dominant in an extensive shrub community. June. (Ph)

15. FAGACEAE

Involucre an open scaly cup, plant deciduous (ours)
1. Quercus
Involucre a closed spiny bur, plant evergreen
2. Castanopsis

1. QUERCUS (Tourn.) L.

1. Q. Garryana Dougl. On open west slope in dry, rocky soil, very rare. (Ph)
Locs. On West Hill at 4000' (906).

2. CASTANOPSIS Spach.

1. C. Chrysophylla (Dougl.) A. DC. On westerly slopes in open dry woods below 4000', infrequent. (Ph)
Locs. Along forest road at 3900' (866) and on "sawlog hill" near rock quarry at 3700' (710).

16. SANTALACEAE

1. COMANDRA Nutt.

1. C. umbellata Nutt. On dry soil in open meadows, mostly southerly slopes, infrequent, June to August. (Ch)
Locs. At the summit (590).

17. ARISTOLOCHIACIAE

1. ASARUM L.

1. A. caudatum Lindl. On moist soil in deep to open woods, common, June to August (Cr)
Locs. Along forest road to lookout at 4500' (766).

18. POLYGONACEAE

Perianth parts 6
Flowers borne in involueres of united bracts, perianth united below 1. Eriogonum

Flowers without an involucre of united bracts, perianth parts nearly distinct — 2. Rumex
Perianth 5-parted (rarely 4) — 3. Polygonum

1. ERIOGONUM Michx

Flowers not stipitate; flowering stems di- or trichotomously branched — 1. E. nudum

Flowers stipitate; flowering stems not branched
Umbels simple; lobes of involucre reflexed — 2. E. umbellatum
Umbels compound; lobes of involucre not reflexed — 3. E. compositum var. pilacaule

1. E. nudum Dougl. Dry, rocky soil in open area, infrequent, September. (H)
Locs. South slope just below the summit of Old Monument (688) (apparently restricted to this one small locality).

2. E. umbellatum Torr. In open areas on dry, rocky soil, chiefly southerly exposures, common, July to September. (Ch)
Locs. Summit (586) also rocky southeast slope at 4600 on Old Monument (668).

3. E. compositum Dougl. var. pilacaule St. John & Warren. Dry rocky soil chiefly southerly exposures, infrequent, August to September. (H)
Locs. Southeast slope of Old Monument at 4600' (669) (942).

2. RUMEX L.

1. R. Acetosella L. Open areas in dry soils chiefly on southerly slopes, infrequent, June to August (Th)
Locs. Treeless area at summit (564).

3. POLYGONUM (Tourn.) L.

Annual; stem branching, wiry, typically prostrate; flowers solitary, axillary — 1. P. aviculare

Perennial; stem erect, usually not branching; flowers in dense terminal racemes — 2. P. Bistortoides

1. P. aviculare L. Open areas in rocky soil principally on southerly exposures, common, August and September, (Th)
Locs. On roadside at 4100 (713) also on treeless areas of West Hill and the summit.

2. P. Bistortoides Pursh. In open areas on moist soil on either north or south slopes, infrequent, June and July. (H)
Locs. At summit (581).

19. PORTULACEAE

Plants with a globose corm — 1. Claytonia
Plants from slender rootstocks or bulbs — 2. Montia

1. CLAYTONIA (Gron.) L.

1. C. lanceolata Pursh. Open areas in gravelly soil, infrequent, June. (Cr)
Locs. Near summit on east slope (770).

2. MONTIA (Mich) L.

Cauline leaves 2, opposite, the blades over 1.5 cm. long; capsule equalling the calyx or nearly so
Racemes bractless; basal leaves nearly orbicular — 1. M. cordifolia
Racemes with numerous bracts; basal leaves ovate, broadly rhombic to rarely lanceolate — 2. M. sibirica
Cauline leaves more than 2, alternate, the blades 0.5 cm. long or less; capsule surpassing the calyx — 3. M. parvifolia

1. M. cordifolia (Wats.) Pax. & Hoffm. In bogs and wet meadows, infrequent, June. (Cr.)
Locs. In a bog at 4400' (768).

2. M. sibirica L. In moist open woods and thickets, very abundant, May to September. (H)
Locs. In moist woods at 4200' (674).

3. M. parvifolia (Moc.) Greene Open areas on gravelly soil, apparently no slope preference, common. (H)
Locs. At summit (573) and on West Hill.

20. CARYOPHLLACEAE

Sepals united into a tubular calyx; petals with conspicuous claws; ovary frequently stipitate — 1. Silene

Sepals distinct or united only at base; petals clawless (occasionally wanting); ovary not stipitate
- Leaves with scarious stipules — 2. Spergularia
- Leaves without stipules; petals rarely wanting
  - Petals bifid or 2-divided — 3. Stellaria
  - Petals entire or merely notched — 4. Arenaria

1. SILENE L.

1. S. Douglasii Hook. Open area on gravelly soils, chiefly southerly slopes, infrequent, June to September. (H)
   Locs. At the summit (575).

2. SPERGULARIA Pers.

1. S. rubra (L.) J. & C. Presl. On dry clay soil in open areas typically on southerly slopes, infrequent, July to September. (H)
   Locs. On cabin road at 4100' (702).

3. STELLARIA L.

Leaves ovate, the lower short petioled; sepals obtuse, rarely wanting — 1. S. obtusa

Leaves lanceolate to elliptic - oblong, all sessile; sepals acute — 2. S. borealis

1. S. obtusa Engelm. Wet soil in open woods, June, very rare. (H)
   Locs. Open southwest slope at 4300' at first switchback (780).

2. S. borealis Bigel. In damp woods along stream bank, infrequent, August. (H)
   Locs. Streambank near cabin (681).

4. ARENARIA L.

1. A. macrophylla Hook. Open woods to dry exposed meadows with gravelly soil, common, May to July. (H)
   Locs. Edge of woods at 4300' at first switchback (767) and on open, rocky hillside at summit (561).

21. RANUNCULACEAE

Flowers zygomorphic
- Upper sepal with a long basal spur — 1. Delphinium
- Upper sepal helmet-shaped, not spurred — 2. Aconitum

Flowers actinomorphic
  Corolla wanting or minute and modified
    Carpel 1, fruit a berry 3. Actaea
    Carpels few to many, fruit not a berry
      Leaves simple, sometimes lobed
        Inflorescence 1-2 flowered, fruit a follicle
          4. Caltha
        Inflorescence a many-flowered terminal panicle, fruit inflated akenes 5. Trautvettaria

      Leaves compound
        Cauline leaves trifoliate, akenes pubescent or feather-tailed 6. Anemone

      Leaves 2-3 ternately compound, akenes glabrous
        7. Thalictrum
  Corolla well developed
    Sepals long-spurred, flowers nodding, fruit follicles
      8. Aquilegia
    Sepals not spurred, flowers not nodding, fruit akenes
      9. Ranunculus

1. DELPHINIUM (Tourn.) L.

1. D. Menziesii Hook. Open woods and dry rocky slopes, common, June to September. (Cr)
   Locs. Open southwest slope at the summit (560), on West Hill and on north slope of Old Monument.

2. ACONITUM (Tourn.) L.

1. A. Howellii Nels. Damp thickets to bogs, infrequent, July to August. (H)
   Locs. In bog near cabin (653).

3. ACTAEA L.

1. A. arguta Nutt. In moist soil in woods, infrequent, June to August. (H)
   Locs. Near road fork at 4100' (760).

4. CALTHA (Rupp.) L.

1. C. biflora DC. Bogs, common, July to August. (H)
   Locs. In a bog near old cabin (808).

5. TRAUTVETTARIA F. & M.

1. T. grandis Nutt. Moist woods and thickets, common June. (H)
   Locs. In Acer-Alnus thicket near cabin (656).

6. ANEMONE (Tourne) L.

Cauline leaves simple, toothed; calyx 2-4 cm. in diameter
1. A. deltoidea
Cauline leaves trifoliate; calyx 1-2 cm. in diameter
Stem puberulent above; stamens 10-25, in 1 series
2. A. Lyallii
Stem glabrous throughout; stamens 30-60, in 2 series
3. A. oregana

1. A. deltoidea Hook. Moist open woods, common, July. (Cr)
Locs. Edge of woods near spring at 4400' (565).

2. A. Lyallii Britt. Moist open woods, common, May to June. (Cr)
Locs. On forest road 3700' (731) and along road near cabin.

3. A. oregana Gray. Moist soil in clearings, common, June. (Cr)
Locs. Near road-fork at 4100' in open woods (733) and along roadside just below the cabin (752).

7. THALICTRUM (Tourn.) L.

1. T. occidentale Gray. In moist woods and thickets, infrequent, June. (H)
Locs. Roadside near cabin in Alnus thicket (755).

8. AQUILEGIA (Tourn.) L.

1. A formosa Fisch. Moist open woods and thickets, common, June to August. (H)
Locs. In Alnus thicket near first switchback (636).

9. RANUCULUS (Tourn.) L.

Leaves typically simple and entire to denticulate, rarely 1-2 lobed; stems short 1-2 dm. high, succulent; nectary scale forming a pocket
1. R. Populago

Leaves variously lobed, parted or compound; stems 2-7 dm. high, not succulent; nectary scale not forming a pocket.
Petals 2-5, 3-5 mm. long; leaves 3-parted
2. R. uncinatus var. parviflorus
Petals 5-7, 10-15 mm. long; leaves pinnately 3-7 foliate
3. R. orthorhynchus

1. R. Populago Greene. In marshy ground, common, June to August. (H)
   Locs. By stream bank just north of cabin (608) and in bog near old cabin.

2. R. unicatus D. Don var. parviflorus (Torr.) L. Benson In open woods, very rare, July. (H)
   Locs. Near the lookout at 4400' (798).

3. R. orthorhynchus Hook. In moist meadows, very rare, July. (H)
   Locs. On the cabin yard (881).

22. BERBERIDACEAE

Perianth wanting, stamens 9-13 — 1. Achlys
Perianth present, stamens 6
  Herbs with leaves 1-2 ternate, fruit a follicle — 2. Vancouveria
  Shrubs, (ours evergreen), fruit a berry — 3. Berberis

1. ACHLYS DC.

1. A. triphylla (Smith) DC. Moist soil in woods or thickets, infrequent, June. (Cr)
   Locs. At 4100' near third road fork (759).

2. VANCOUVERIA Morr. & Dec.

1. V. hexandra (Hook.) Morr. & Dcne. In deep woods below 4000', infrequent, July. (Cr)
   Locs. Lower West Ridge at 3700' (903).

3. BERBERIS L.

Leaflets 9-15, somewhat palmately veined; bud scales 1.5-4 cm. long, persistent — 1. B. nervosa

Leaflets 5-9, pinnately veined; bud scales 2-5 mm. long, more or less deciduous — 2. B. Aquifolium

1. B. nervosa Pursh. Open woods and marginal areas, common, June. (Ch)
   Locs. Edge of woods on east slope on West Hill (742).

2. B. Aquifolium Pursh. Open woods and thickets, infrequent, June. (Ch)
   Locs. At the summit at margin of woods (735).

23. FUMARIACEAE

L. DICENTRA Bernh.

1. D. formosa (Andr.) DC. In moist soil in open woods and disturbed south slopes, common, June to September. (Cr)
   Locs. Along the lookout road at 4200' (629).

24. CRUCIFERAE

Valves of the siliques nerveless
  Rootstocks tuberous, stem leafy only near the inflorescence ..... 1. Dentaria

  Rootstocks not tuberous, stem leafy for entire length ..... 2. Cardamine

Valves of siliques nerved at least below
  All the leaves simple, plants pubescent
    Lower leaves sessile and usually auriculate, petals white ..... 3. Arabis

    Lower leaves long petioled, petals yellow or orange ..... 4. Erysimum

  Some of the leaves pinnately compound, plants glabrous ..... 5. Campe

1. DENTARIA L.

1. D. tenella Nutt. var. pulcherrima (Greene) Peck.
   Open woods in moist soil, infrequent, May to June. (Cr)
   Locs. Edge of woods, south slope near road fork 4100' (772).

2. CARDAMINE (Tourn.) L.

1. C. Breweri Wats. var. orbicularis (Greene) Detl. In bogs and sluggish streams, infrequent June to August. (Cr)
   Locs. In a bog at 4000' (748) and in a running stream near cabin (883).

3. ARABIS L.

Leaves and lower part of stem gray canescent; pedicels sharply reflexed ..... 1. A. Holboellii var. secunda

Leaves and stem not canescent; pedicels erect ..... 2. A. hirsuta

1. A. Holboellii Hornem. var. secunda (How.) Jeps. Dry rocky soil open areas principally southerly exposures, infrequent, July. (H)
Locs. Near the summit on open south slope (858) also at summit of Old Monument.

2. A. hirsuta (L) Scop. Open areas with moist soil, very rare, July. (H)
Locs. North slope of east ridge 4500' (807).

4. ERYSIMUM (Tourn.) L.

1. E. asperum (Nutt.) DC. Open areas, common June to September. (H)
Locs. At the summit (579).

5. CAMPE Dulac.

1. C. orthoceras Ledeb. var. dolichocarpa Fern. On moist soil in open woods or disturbed areas, infrequent, June to July. (H)
Locs. Roadside above cabin (756) and in damp woods (612).

25. CRASSULACEAE

1. SEDUM L.

Petals united a third of their length or more
1. S. oregonense
Petals nearly or entirely separate to the base
Leaves mostly opposite, very thick, somewhat obovoid, reddish, not distinctly glaucus; carpels widely spreading
2. S. divergens
Leaves alternate, broadly spatulate, not reddish, very glaucus; carpels slightly divergent
3. S. spathulifolium

1. S. oregonese (Wats.) Peck. Dry rocky soil, open southerly exposures, infrequent, July to August. (Ch)
Locs. Rock outcrop at the summit (856).

2. S. divergens Wats. Cliffs and rocky soil, infrequent July to August. (Ch)
Locs. At the summit (917). (Not formerly reported west of the Cascades)

3. S. spathulifolium Hook. Ledges and rocky soil, common, July to September. (Ch)
Locs. Rock outcrop at the summit (856).

26. SAXIFRAGACEAE

Fertile stamens 10
  Fruit a capsule with axial placentae, or a pair of follicles — 1. Saxifraga

  Fruit a capsule with 2 parietal placentae
    Petals white, clawed, not pinnatifid — 2. Tiarella
    Petals deeply pinnatifid, not clawed — 3. Tellima
Fertile stamens fewer than 10
  Stamens 3, calyx irregular — 4. Tolmiea
  Stamens 5, calyx regular
    Ovary 2-loculed, placentae axial — 5. Boykinia
    Ovary 1-loculed, placentae parietal
      Inflorescence many flowered placentae 2 — 6. Heuchera
      Inflorescence solitary, placentae 4 — 7. Parnassia

1. SAXIFRAGA (Tourn.) L.

Stems leafy; petals white with red dots — 1. S. bronchialis var. austromontana
Leaves basal; petals without red dots
  Petals clawless, without spots; filaments narrowly subulate — 2. S. rufidula

  Petals long clawed, 2 or 3 with pair of yellow spots; filaments linear — 3. S. ferruginea

1. S. bronchialis L. var. austromontana (Wieg.) Piper. Moist rocky cliffs chiefly north slopes, infrequent, June to August. (H)
   Locs. In a rocky crevice at the summit (576).

2. S. rufidula (Small) Johns. Rocky soil open areas principally southerly slopes, common, June to July. (H)
   Locs. Open area at 4500' (602) and at the summit, also on West Hill.

3. S. ferruginea Graham. Open woods and moist banks, infrequent, June to July. (H)
   Locs. Open woods (603).

2. TIARELLA L.

1. T. unifoliata Hook. Moist woods and thickets, common,
   Locs. Open woods near cabin (665).

3. TELLIMA R. Br.

1. T. grandiflora (Pursh.) Dougl. Moist soil in thickets and disturbed areas of the forest, infrequent. July to August. (H)
   Locs. Edge of woods at first switchback (655).

4. TOLMIEA T. & G.

1. T. Menziesii (Pursh.) T. & G. In moist woods and thickets, infrequent, July to August. (H)
   Locs. In woods near the cabin (650).

5. BOYKINIA Nutt.

1. B. major Gray. Moist soil in thickets and open woods, common, June to July. (H)
   Locs. At the summit on exposed rocky soil (572).

6. HEUCHERA L.

1. H. micrantha Dougl. var. pacifica R. B. L. Open southerly exposures in rocky soil, common, June to July. (H)
   Locs. At the summit on exposed rocky soil (572).

7. PARNASSIA (Tourn.) L.

1. P. fimbriata Konig. In bogs, infrequent, August to September. (H)
   Locs. In a bog near the old cabin (704).

27. RIBESACEAE

1. RIBES L.

Calyx saucer-shaped
  Stems prickly; leaves 0.5 dm. wide or less
    1. R. lacustre
  Stems not prickly; leaves 1-2.5 dm. wide
    2. R. bracteosum
Calyx not saucer-shaped
  Flowers red or pink; leaves densely tomentulose beneath
    3. R. sanguineum
  Flowers not red; leaves puberulent below
    4. R. viscosissimum

1. R. lacustre (Pers.) Poir. Moist open woods and thickets, common, June to July. (Ph)
   Locs. Just above road fork at 4100', roadside (763).

2. R. bracteosum Dougl. In moist shady woods and thickets, common, June to July. (Ph)
   Locs. In alder-maple thicket at 4200' (761) and along stream in dense shade below the falls (708).

3. R. sanguineum Pursh. Thickets and open woods below 4000' infrequent. (Ph)
   Locs. Roadside at 3700' (727).

4. R. viscosissimum Pursh. Open woods, common, June to July. (Ph)
   Locs. In deep shade on West Ridge at 4400' (800) and at second switchback (670).

28. ROSACEAE

Leaves simple, often lobed
- Carpels 1
  - Carpel 2-ovuled, fruit a fleshy drupe — 1. Prunus
  - Carpel 1-ovuled, fruit a pome — 2. Crataegus
- Carpels more than 1
  - Fruit dry
    - Carpels glabrous forming several-seeded follicles, stamens well exserted — 3. Spiraea
    - Carpels hairy forming 1-seeded capsules, stamens not exserted — 4. Holodiscus
  - Fruit fleshy
    - Carpels many, forming an aggregate fruit of many drupelets — 5. Rubus
    - Carpels 2-5, fruit a small pome
      - Flowers in racemes — 6. Amelanchier
      - Flowers in corymbs — 2. Crataegus

Leaves compound
- Trees or shrubs or woody vines
  - Fruit a hip enclosing the akenes — 7. Rosa
  - Fruit not a hip with akenes
    - Leaflets 3-5, fruit an aggregate of many drupelets — 5. Rubus
    - Leaflets 7-15, fruit a pome — 8. Sorbus
- Herbs
  - Plants essentially acaulescent; receptacle fleshy in fruit — 9. Fragaria

Plants not acaulescent; receptacle not fleshy in fruit
10. Potentilla

1. PRUNUS (Tourn.) L.

1. P. emarginata (Dougl.) Walp. var. erecta (Presl.) Piper. Woods, infrequent, June. (Ph)
Locs. In alder thicket just above cabin (677).

2. CRATAEGUS L.

1. C. Douglasii Lindl. Woods and thickets, very rare. (Ph)
Locs. Just below third road fork at 4100'.

3. SPIRAEA (Tourn.) L.

1. S. densiflora Nutt. Moist soil in open woods, common, July to August. (Ph)
Locs. In meadow near cabin (648).

4. HOLODISCUS Maxim.

1. H. discolor (Pursh.) Maxim. Thickets and open woods particularly along margins of woods, common, July to August. (Ph)
Locs. In ecotone between noble fir and rock-fell communities, near the summit (643).

5. RUBUS (Tourn.) L.

Stems erect, 1-3 m. tall
Leaves trifoliately compound, petals red
1. R. spectabilis
Leaves lobed but simple; petals white
2. R. parviflorus
Stems trailing, creeping, or climbing
Fruit deep red; petals shorter than calyx-lobes
3. R. lasiococcus
Fruit black; petals longer than calyx-lobes
4. R. vitifolius

1. R. spectabilis Pursh. In moist open woods and thickets and along stream banks, common, June to July. (Ph)
Locs. Edge of cabin yard (642).

2. R. parviflorus Nutt. Open woods and thickets, very abundant, June to September. (Ph)
Locs. Edge of woods just above road-fork (662).

3. R. lasiococcus Gray. Moist open woods to rather dry rocky exposures, common, July to September. (Ch)
Locs. In yard at cabin (625), also at the summit.

4. R. vitifolius C. & S. On rocky soil in open areas below 4000', infrequent, June to July. (Ch)
Locs. At entrance to forest road, 3700' (790).

6. AMELANCHIER Medic.

1. A. florida Lindl. Dry open woods and thickets typically with a southerly exposure, common, June to July. (Ph)
Locs. In ecotone between rock-fell and noble fir communities on East Ridge at 4500' (618).

7. ROSA L.

Stems with abundant slender straight prickles; petals under 15 mm. long, calyx deciduous 1. R. gymnocarpa

Stems with very few to no prickles; petals 2 cm. long or longer; calyx persistent to the hip 2. R. Spaldingii

1. R. gymnocarpa Nutt. Rather dry soil in woods, common, June to August. (Ph)
Locs. Semi-open woods (644).

2. R. Spaldingii Crepin. In thickets in rather dry situations, infrequent, July to August. (Ph)
Locs. At the summit on west slope (601 and 712).

8. SORBUS (Tourn.) L.

Leaves serrate only near the apex; fruit broadly obovoid, light red, petals about 3 mm. long 1. S. occidentalis

Leaves serrate except near the base; fruit globose to broadly oval, orange or coral red; petals 3.5 to 5 mm. long 2. S. sitchensis

1. S. occidentalis (Wats.) Greene. At high altitudes in open areas, very rare, June to July. (Ph)
Locs. Along the trail up Old Monument. Two specimens in the O.S.C. Herbarium (Nos. 52442 and 56911) collected by Dr. H. M. Gilkey.

2. S. sitchensis Roem. In open woods, infrequent, July. (Ph)
Locs. Cabin yard (678) and on north slope of East Ridge at 4500' (855).

9. FRAGARIA (Tourn.) L.

Peduncles shorter than the leaves; fruit globose 1. F. platypetala

Peduncles equalling or surpassing the leaves; fruit ovoid, constricted at the base 2. F. bracteata

1. F. platypetala Rydb. Gravelly soil in meadows, common, June to August. (H)
Locs. At the summit in the open area (779).

2. F. bracteata Hel. Open woods and meadows, infrequent, July to August. (H)
Locs. In cabin yard (610).

10. POTENTILLA L.

Basal leaves pinnately compound, stem glandular-villous; calyx glandular 1. P. glandulosa

Basal leaves 5-7 palmately compound, stem and calyx pubescent but not glandular 2. P. gracilis

1. P. glandulosa Lindl. Dry open meadows, infrequent, July to August. (H)
Locs. Open area at the summit (574).

2. P. gracilis Dougl. Open meadows, infrequent, August to September. (H)
Locs. Cabin yard (660).

29. LEGUMINOSAE

Filaments all distinct 1. Thermopsis

Filaments not all distinct
  Stamens monodelphous; anthers appearing to be of two forms, the younger alternating with the older; calyx bilabiate
    Leaves unifoliate or trifoliate; shrubs 2. Cytisus
    Leaves 5-16 foliate; (ours) herbs 3. Lupinus
  Stamens diadelphous; anthers all alike; calyx not bilabiate though sometimes slightly irregular
    Leaves 3-5 palmately compound; wings of the corolla free from keel 4. Trifolium

Leaves pinnately compound; wings of the corolla adherent to the keel
  Style terete; the capitate stigma ringed with hairs
    5. Vicia
  Style flattened; only upper side of stigma hairy
    6. Lathyrus

1. THERMOPSIS R. Br.

1. T. gracilis How. Moist open woods, infrequent, below 4000' and apparently absent above that elevation, June. (H)
Locs. At the first road fork (793).

2. CYTISUS (Tourn.) L.

1. C. scoparius L. Meadow, very rare, (probably purposely introduced). (Ph)
Locs. A single specimen observed in the cabin yard but not collected.

3. LUPINUS (Tourn.) L.

1. L. latifolius Agh. var. subalpinus (Piper & Robins) C. P. Sm. Moist meadows and disturbed areas, common, June to September. (H)
Locs. In cabin yard (619) also at the summit.

4. TRIFOLIUM (Tourn.) L.

Flowers becoming reflexed after anthesis; corollas white 8-10 mm. long; stems creeping or rooting 1. T. repens

Flowers not becoming reflexed; corollas purplish-red 15-18 mm. long; stems clustered, erect or spreading
  2. T. pratense

1. T. repens L. Meadow, very rare, July to September. (H)
Locs. Cabin yard (661). Naturalized from Europe; obviously an adventive.

2. T. pratense L. Meadow, very rare, August. (H)
Locs. Cabin yard (684). Naturalized from Europe; obviously an adventive.

5. VICIA (Tourn.) L.

1. V. americana Muhl. Meadows and open woods, not common, July and August. (H)
Locs. A quarter of a mile below third road fork 3800' in clay soil at roadside (791) and at edge of woods near cabin.

6. LATHYRUS (Tourn.) L.

1. L. polyphyllus Nutt. Open woods and thickets, infrequent, July and August. (H)
Locs. In a shrub thicket on West Ridge at 4300' (828).

30. OXALIDACEAE

1. OXALIS L.

1. O. oregana Nutt. Coniferous woods, common, June. (Cr)
Locs. In a Douglas fir forest on West Ridge at 3900' (741) also in Tsuga-Abies forest.

31. CELASTRACEAE

1. PACHYSTIMA Raf.

1. P. myrisinites (Pursh.) Raf. Margins of woods and on rocky, exposed slopes, common, May to June. (Ph)
Locs. At base of forest road (725) and near the summit on south slope of East Ridge (700).

32. ACERACEAE

1. ACER (Tourn.) L.

1. A. circinatum Pursh. Damp open woods, very abundant, June. (Ph)
Locs. Just below road fork, 4100' (641). (One of the dominants in the large Acer-Alnus community)

33. RHAMACEAE

1. CEANOTHUS L.

Leaves glutinous above and glandular-serrate
1. C. velutinus
Leaves neither glutinous nor glandular-serrate
2. C. sanguineus

1. C. velutinus Dougl. Open rocky soil and dry slopes, infrequent, July and August. (Ph)
   Locs. On East Ridge between noble fir and rock-fell communities, just below summit (966).

2. C. sanguineus Pursh. Thickets on dry slopes, infrequent below 4000' and apparently absent above, September. (Ph)
   Locs. Edge of woods, at 3700' (707).

34. HYPERICACEAE

1. HYPERICUM L.

Petals copper colored, 3-4 mm. long; stems 3-30 cm. high — 1. H. anagalloides
Petals bright yellow, 8-12 mm. long; stems 5-10 dm. high — 2. H. perforatum

1. H. anagalloides C. & S. In bogs and stream margins, infrequent, July to August. (H)
   Locs. In saturated soil near spring at 4400' (595).

2. H. perforatum L. Meadows and roadsides, infrequent, July to September. (H)
   Locs. Cabin yard (663).

35. VIOLACEAE

1. VIOLA (Tourn.) L.

Corolla white; plant very small — 1. V. Macloskeyi
Corolla yellow; plant medium sized
  Stems naked below and erect; leaves deciduous — 2. V. glabella
  Stems leafy below and stolon-like; leaves evergreen — 3. V. sempervirens

1. V. Macloskeyi Lloyd. In bogs and stream margins, infrequent, June to July. (Cr)
   Locs. Stream banked near cabin (754).

2. V. glabella Nutt. Moist open woods and disturbed areas, common, June to September. (H)
   Locs. In the road just above first switchback (646).

3. V. sempervirens Greene. Open woods, infrequent below 4000' apparently absent above, May to June. (H)
   Locs. At base of forest road at 3600' (726).

36. ONAGRACEAE

Petals usually emarginate, seeds with a long coma
1. Epilobium
Petals not emarginate, seeds without a coma
2. Gayophytum

1. EPILOBIUM L.

Hypanthium prolonged beyond the ovary; petals under 1 cm. in length, usually notched
Annuals; stem with exfoliating epidermis; leaves linear-lanceolate to oblong-lanceolate, 1-2 cm. long
1. E. minutum
Perennials; epidermis not exfoliating; leaves mostly more than 2 cm. long, or if less, elliptic to ovate
Rootstocks bearing fleshy turions; petals 7-9 cm. long
2. E. glandulosum
Rootstocks not bearing turions though sometimes with rather fleshy rosettes; petals 3-6 mm. long
Leaves sessile or nearly so, dark green, 3.5-6 cm. long and with conspicuous lateral veins; stem typically over 3 dm. tall
Leaves ovate to elliptical lanceolate; petals white or pinkish, 4 mm. long 3. E. adenocaulon

Leaves narrowly lanceolate to triangular; petals purple or rose 5-6 mm. long 3a. E. adenocaulon var. occidentale
Leaves short-petioled, pale to medium green, under 3.5 cm. long and with inconspicuous lateral veins; stems typically 1-3 dm. tall
Stems typically branched, some of the upper leaves alternate and with fascicles of leaves in the axils; seeds papillose 3b. E. adenocaulon var. perplexans
Stems simple; leaves opposite, without fascicles of leaves in axils; seeds smooth
4. E. lactiflorum
Hypanthium not prolonged beyond the ovary; petals 1.5-2 cm. long, entire
5. E. angustifolium

1. E. minutum Lindl. Open areas, dry rocky soil, infrequent, September. (Th)
Locs. Southwest slope along forest road at 4000' (976) and in gravel bed at 3400' (962).

2. E. glandulosum Lehm. Bogs and moist ground in thickets, common, July to September. (Cr)
Locs. In bog near cabin (958), margin of Alnus thicket at 4200' below first switchback (959) and just below the first switchback (968).

3. E. adenocaulon Hausskn. Wet places, along forest margins, infrequent, July to August. (H)
Locs. At margin of Alnus thicket at 4200' (960).

3a. E. adenocaulon Hausskn. var. occidentale Trel. Moist soil in open woods and disturbed soil, common July to August. (H)
Locs. Roadside at 4000' (865).

3b. E. adenocaulon Hausskn. var. perplexans Trel. Moist roadsides, infrequent, July to August. (H)
Locs. Along lookout road above spring 4400' (969).

4. E. lactiflorum Hausskn. Moist open woods, infrequent, June to July. (H)
Locs. Open woods at 4200' (813).

5. E. angustifolium L. Open woods and roadsides, common August to September. (H)
Locs. Open woods at 4000' (687).

2. GAYOPHYTUM Juss

1. G. humile Juss. Dry gravelly soil, south slopes, very rare, June to July. (Th)
Locs. At 4600' below old lookout site (804).

37. ARALIACEAE

1. OPLOPANAX Mig.

1. O. horridum (Sm.) Mig. In deep shady woods and moist thickets, common, July. (Ph)
Locs. Stream bank just below falls (709) and in Alnus sinuata thicket at 4200' (900).

38. UMBELLIFERAE

Leaflets pinnate, linear, dissected or small; outer petals little different from others

Mature fruits linear, 10 times as long as wide
1. Osmorhiza

Fruits not linear, relatively much shorter
  Fruits strongly flattened dorsally 2. Lomatium
  Fruits moderately or not at all flattened dorsally
    Dwarf plants with linear leaf-segments, stylopodium flattened 3. Orogenia

    Leaflets ovate; stylopodium conical 4. Ligusticum
Leaflets very broad; (not dissected, linear or pinnatifid) outer petals of outer flowers larger than the inner and deeply obcordate 5. Heracleum

1. OSMORHIZA Raf.

Fruit glabrous, abruptly narrowed toward the apex but not beaked; umbels 6-16 rayed 1. O. occidentalis

Fruit retrosely bristly-hispid below and along the angles above, the apex abruptly beaked; umbels 3-8 rayed 2. O. nuda

1. O. occidentalis Torr. Moist open woods, infrequent, June. (H)
   Locs. Edge of woods at 4250' along lookout road (787).

2. O. nuda Torr. In moist woods, infrequent, July. (H)
   Locs. In shady low woods near first switchback (853).

2. LOMATIUM Raf.

1. L. Martindalei C. & R. Open areas, dry rocky southerly exposures, very abundant, May to July. (H)
   Locs. At the summit (587) and on West Hill (819).

3. OROGENIA Wats

1. O. fusiformis Wats. Dry open meadows, infrequent, June. (H)
   Locs. At the summit (744).

4. LIGUSTICUM L.

1. L. apiifolium (Nutt.) Gray. Open woods and meadows, infrequent, August to September. (H)
   Locs. Meadow near cabin (667).

5. HERACLEUM L.

1. H. lanatum Michx. Moist open woods and stream banks, common, July to September. (Cr)
   Locs. Roadside near cabin (871).

39. CORNACEAE

1. CORNUS (Tourn.) L.

1. C. canadensis L. Moist woods, common, June to August. (H)
   Locs. Open woods near cabin (596).

40. ERICACEAE

Herbs (sometimes with woody bases); petals separate or united only below
  White or yellowish fleshy plants; ovary 1-loculed
    1. Pleuricospora
  Plants usually green; ovary 5-loculed
    Flowers in corymbs or umbels; filaments dilated at middle or base
      2. Chimaphila
    Flowers in terminal racemes; filaments not dilated
      3. Pyrola

Shrubs
  Anthers awnless (see also Vaccinium ovatum)
    Flower parts in 4's; corollas under 1 cm. wide
      4. Menziesia
    Flower parts in 5's; corollas over 2.5 cm. wide
      5. Rhododendron
  Anthers bearing a pair of awns (awnless in Vaccinium ovatum)
    Sepals distinct; locules of ovary 1-seeded
      6. Arctostaphylos
    Sepals united; locules of ovary 2-or-more-seeded
      7. Vaccinium

1. PLEURICOSPORA Gray

1. P. fimbriolata Gray. In deep coniferous woods, very rare, September to October. (Cr)
   Locs. In deep noble fir forest at 4300' (991).

2. CHIMAPHILA Pursh.

1. C. Menziesii (R. Br.) Spreng. In woods, infrequent, July to August. (Ch)
   Locs. In edge of woods at 4400' (689).

3. PYROLA (Tourn.) L.

1. P. dentata Smith. Coniferous forest, infrequent, July to August. (H)
   Locs. In deep noble fir forest near first switchback (771) and at edge of noble fir community near first switchback (961).

4. MENZIESIA Sm.

1. M. ferruginea Hook. In open woods and thickets, common, June and July. (Ph)
   Locs. South of cabin along road (811).

5. RHODODENDRON L.

1. R. macrophyllum G. Don. In moist open woods and forest margins, common below 4000', June to July. (Ph)
   Locs. Along forest road at 3800' (792) also on West Hill.

6. ARCTOSTAPHYLOS Adans.

Large erect shrubs; leaves 2.5 - 6 cm. long, tomentose ..... 1. A. columbiana

Low prostrate, trailing or decumbent shrubs; leaves 16-25 mm. long, glabrous to puberulent

- Corrola white, urceolate, much longer than broad; branches rigid ..... 2. A. nevadensis
- Corolla mostly pinkish, broadly ovoid; branches not rigid ..... 3. A. Uva-ursi

1. A. columbiana Piper. Dry southerly slopes, rocky soil, infrequent below 4000' absent above, May to June. (Ph)
   Locs. "Saw-log Hill", 3600' (728).

2. A. nevadensis Gray. Southerly slopes, rocky soil, common, July. (Ch)
   Locs. West Hill (817).

3. A. Uva-ursi (L.) Spreng. Open areas, rocky soil, common, June to July. (Ch)
   Locs. At the summit (758).

7. VACCINIUM L.

Fruit red; corolla greenish white; leaves 1.5 - 2.5 cm. long; branches nearly erect ..... 1. V. parvifolium

Fruit blue or black; corolla pinkish; leaves 2.5 - 5 cm. long; branches spreading
  Leaves distinctly serrate; berry purplish to black without a bloom; flowers opening after the leaves 2. V. membranaceum
  Leaves entire or nearly so; berry deep blue with a bloom; flowers opening before the leaves 3. V. ovalifolium

1. V. parvifolium Smith. Open woods and disturbed areas, common below 4000', June. (Ph)
   Locs. Along forest road at 3700' (699).

2. V. membranaceum Dougl. Open woods and thickets, common, June. (Ph)
   Locs. In open forest near cabin (692 & 750).

3. V. ovalifolium Smith. Woods and thickets, common, June. (Ph)
   Locs. Open woods just south of cabin (751) and in cabin yard (691).

41. PRIMULACEAE

Leaves all basal, calyx and corolla lobes reflexed in flower Dodecatheon

Leaves not all basal, calyx and corolla lobes not reflexed Trientalis

1. DODECATHEON L.

1. D. Jeffreyi Van Houtte. In bogs and very wet soil, infrequent, June to July. (H)
   Locs. In a bog at 4400' near spring (769 & 605).

2. TRIENTALIS L.

1. T. latifolia Hook. Open woods and thickets, infrequent, July to August. (Cr)
   Locs. Along forest road at 3900' (789).

42. POLEMONIACEAE

Leaves mainly opposite (occasionally the upper alternate) and entire; stamens unequally inserted.
  Flowers very small; annuals 1. Microsteris
  Flowers medium to larger; mostly perennials 2. Phlox

Leaves mostly alternate, compound, divided, toothed or sometimes entire; stamens equally inserted.
Calyx herbaceous throughout; leaves pinnately compound 3. Polemonium
Calyx scarious below the sinuses; leaves entire to deeply divided but not compound 4. Gilia

1. MICROSTERIS Greene

1. M. gracilis (Dougl.) Greene. Dry soil, open areas, common, June to September. (Th)
Locs. In cabin yard (614) and at the summit (583).

2. PHLOX L.

Leaves linear or linear-subulate, connate clasping at the base; calyx typically villous, not glandular 1. P. diffusa var. longistylis
Leaves elliptic to ovate or obovate, cuneate to cordate at base; calyx typically glandular not villous 2. P. adsurgens

1. P. diffusa Benth. var. longistylis Wher. Dry southerly slopes, rocky soil, common, July to September. (Ch)
Locs. West Hill (743) and on North Ridge.

2. P. adsurgens Torr. Open woods and disturbed areas, common, June to September. (H)
Locs. Open woods (620).

3. POLEMONIUM (Tourn.) L.

1. P. carneum Gray. Open woods and disturbed areas in moist soil, common, June to July. (H)
Locs. Edge of woods just below the summit (563).

4. GILIA Ruiz. & Pav.

1. G. capitata Hook. In open dry soil, infrequent, July to September. (Th)
Locs. At the summit (599) and on North Ridge.

43. HYDROPHYLLACEAE

Inflorescence scorpioid, raceme-like or spike-like 1. Phacelia
Inflorescence not scorpioid, corymb-like, or head-like 2. Hydrophyllum

1. PHACELIA Juss.

1. P. heterophylla Pursh. Open woods and disturbed areas, common, July to September. (H)
   Locs. Roadside near second switchback (597).

2. HYDROPHYLLUM (Tourn.) L.

Leaves 3-parted; filaments glabrous, corolla pale blue to nearly white ..... 1. H. tenuipes

Leaves 5-11-parted; filaments hairy; corolla deep blue ..... 2. H. occidentale

1. H. tenuipes Hel. Deep moist woods, infrequent, July. (H)
   Locs. In dense Alder thicket in the Alnus-Acer community on south slope at 4200' (874).

2. H. occidentale Gray. Open woods, damp soil, infrequent, June. (H)
   Locs. On a clay bank near first switchback (765).

44. BORAGINACEAE

1. MERTENSIA Roth

1. M. paniculata (Ait.) G. Don var. borealis (Macbr.) Wms. Deciduous woods and thickets in moist situations, common, June to September.(H)
   Locs. Open woods near first switchback (592) and in alder-maple community.

45. LABIATAE

Flowers in a dense terminal spike-like inflorescence; corolla throat dilated ..... 1. Prunella

Flowers in axillary clusters and/or interrupted terminal spikes; corolla throat not dilated ..... 2. Stachys

1. PRUNELLA L.

1. P. vulgaris L. Open woods and meadows, common, July to September. (H)
   Locs. In cabin yard (649).

2. STACHYS (Tourn.) L.

Corolla deep red, 15-25 mm. long with a transverse ring of hairs near base of tube 1. S. ciliata

Corolla pinkish, under 10 mm. long, with an oblique ring of hairs 2. S. rigida

1. S. ciliata Dougl. Moist open woods and stream banks, common, July to September. (Cr)
   Locs. Edge of the woods near the cabin (651).

2. S. rigida Nutt. var. rivularis (Hel.) Epl. Open woods and thickets, moist soil, infrequent, August to September. (Cr)
   Locs. Along lookout road just above road fork (624).

46. SCROPHYLARIACEAE

Corolla not bilabiate; functional stamens 2
  Plant caulescent, leaves mainly opposite 1. Veronica
  Plant acaulescent or nearly so, leaves mainly basal 2. Synthyris
Corolla bilabiate; functional stamens 4
  Calyx prismatic (usually) and stigma 2-lipped 3. Mimulus
  Calyx not prismatic nor stigma 2-lipped
    Upper lip of corolla not narrow elongate or helmet-shaped, rather similar to the lower; leaves opposite
      Sterile filament elongate 4. Penstemon
      Sterile filament vestigial, scale-like 5. Collinsia
    Upper lip narrow and elongate or helmet-shaped, very different from the lower; leaves alternate
      Anther sacs equal and parallel 6. Pedicularis
      Anther sacs unequal
        Upper corolla lip much longer than the lower 7. Castilleja
        Lips of corolla about equal 8. Orthocarpus

1. VERONICA (Tourn.) L.

Racemes several, axillary; plant glabrous 1. V. americana
Racemes one, terminal; plant glandular-pubescent 2. V. humifusa

1. V. americana (Raf.) Schwein. On stream banks and swampy areas, infrequent, August. (Ch)
Locs. Stream bank near cabin (971).

2. V. humifusa Dicks. Moist meadows and damp clay soil in disturbed areas, infrequent, July to August. (H)
Locs. In cabin yard (630) and near road-fork at 4100' (820).

2. SYNTHYRIS Benth.

1. S. reniformis Benth. Wet open woods and disturbed areas, infrequent, May to June. (H)
Locs. Edge of woods at 3800' (730).

3. MIMULUS L.

Calyx nearly regular; corolla not exceeding 2 cm. in length, always less (except in M. moschatus)
- Corolla red — 1. M. Breweri
- Corolla yellow with red spots or stripes
  - Perennial; slimy-villous, capsule much shorter than calyx — 2. M. moschatus
  - Annual; glabrous or minutely puberulent; capsule about equaling the calyx — 3. M. alsinoides

Calyx decidedly irregular; corolla 2-3, 5 cm. long — 4. M. guttatus

1. M. Breweri (Greene) Cov. Dry open areas, rocky soil, infrequent, July. (Th)
Locs. Open area at the summit (567).

2. M. moschatus Dougl. Bogs and wet clay banks, infrequent, July to August. (H)
Locs. Marshy area near the spring (616) and on moist clay bank on forest road at 4000' (867).

3. M. alsinoides Dougl. Wet clay banks, very rare, June. (Th)
Locs. Clay bank along forest road at 3900' (740).

4. M. guttatus DC. Wet ground in open woods and disturbed areas, common, July to August. (H)
Locs. In wet clay bank near the spring at 4400' (617).

4. PENSTEMON (Mitch) Ait.

Anthers opening from the distal apex throughout or partially; sterile stamen shorter than the longer fertile pair
  Anthers densely comose; calyx glandular pubescent; leaves sinuate to variously toothed; corolla 2.5-3 cm. long
    Inflorescence simple of nearly so, the peduncles 1-2-flowered; capsule pyramidal-ovoid, acuminate; seeds not winged; middle lobe of lower lip of corolla not conspicuously longer than the lateral ones; plants largely woody, less than 5 dm. tall
      Stems spreading or sometimes slightly procumbent; leaves lance-oblong to narrowly ovate or elliptic-ovate, green, 2-4 cm. long; calyx greenish
        1. P. Cardwellii
      Stems prostrate or creeping; leaves broadly ovate to obovate or nearly orbicular to spatulate, usually glaucous 6-15 mm. long; calyx purplish
        2. P. rupicola
    Inflorescence compound, the branches several flowered; capsule ellipsoid; seeds broadly winged; middle lobe of lower lip of corolla conspicuously longer than the lateral ones; plants woody only at base, 4-12 dm. tall
      3. P. nemorosus
  Anthers glabrous or nearly so; calyx glabrous; leaves entire; corolla 7-12 mm. long
    4. P. procerus
Anthers opening from the proximal apex, the distal portions pouch-like; sterile stamen surpassing the fertile
  5. P. serrulatus

1. P. Cardwellii How. Open woods and meadows to rather dry rocky soil, common, June to August. (Ch)
   Locs. At edge of woods on forest road at 3750' (801) also in open area at the summit, and near top of Old Monument (802).

2. P. rupicola How. Cliffs and ledges, common, June to August. (Ch)
   Locs. On a rock outcrop at summit (591 & 593) and on north facing cliff of East Ridge, and on east face of a cliff of Old Monument.

3. P. nemorosus (Dougl.) Trautv. Woods and meadows, and rarely on exposed, rocky soil, infrequent, July to September. (H)
   Locs. Exposed west slope behind cabin (640) also on West Hill and at summit in edge of woods.

4. P. procerus Dougl. Meadows and open areas on rocky soil, infrequent, June to August. (H)
Locs. On grassy south slope at the summit (577).

5. P. serrulatus Menz. Open woods and disturbed areas, common, July to September. (H)
Locs. Roadside near the spring at 4400' (598) and just below the first switchback (647).

5. COLLINSIA Nutt.

Corolla 10-15 mm. long, the limb longer than the tube
1. C. grandiflora
Corolla 6-10 mm. long, the limb not longer than the tube
2. C. parviflora

1. C. grandiflora Dougl. Moist ground open woods, infrequent, June to July. (Th)
Locs. Edge of woods by the first switchback (562).

2. C. parviflora Dougl. Open areas, meadows and gravelly, southerly slopes, common, June to August. (Th)
Locs. Grassy southwest slope at the summit (568), also on West Hill.

6. PEDICULARIS (Tourn.) L.

1. P. racemosa Dougl. Woods and moist meadows, common, July to September. (H)
Locs. Open woods near the cabin (615).

7. CASTILLEJA Mutis

Stem pubescent throughout; main leaves pinnately lobed
1. C. hispida
Stem glabrous or puberulent below the inflorescence; main leaves entire
2. C. miniata

1. C. hispida Benth. Open ground chiefly southerly exposures, common, June to August. (H)
Locs. West Hill rocky northwest slope (736) and at the summit in the open meadow (795).

2. C. miniata Dougl. Meadows and open woods, common, July to September. (H)
Locs. Cabin yard (639).

8. ORTHOCARPUS Nutt.

1. O. imbricatus Torr. Dry meadows, infrequent, July to September. (Th)
   Locs. Rocky soil at the summit (600).

47. OROBANCHACEAE

1. OROBANCHE (Tourn.) L.

1. O. uniflora L. Parasitic on various plants but especially on species of Saxifraga growing on open west slopes in gravelly soil, infrequent, June to July. (Cr)
   Locs. At the summit in open area (569) and on West Hill.

48. PLANTAGINACEAE

1. PLANTAGO (Tourn.) L.

Leaves ovate; capsule 8-16 seeded — 1. P. major
Leaves lanceolate or oblong-lanceolate to nearly linear; capsule 2-seeded — 2. P. lanceolata

1. P. major L. Clay soil, roadsides, infrequent, August to September. (H)
   Locs. Roadbed near third road fork at 4100' (715).

2. P. lanceolata L. Meadows and disturbed areas, common, June to August. (H)
   Locs. Edge of Alnus thicket on lookout road at 4200' (697).

49. RUBIACEAE

1. GALIUM L.

Leaves 1-2 cm. long; fruit glabrous — 1. G. cymosum
Leaves 2-4 cm. long; fruit clothed with hooked bristles or uncinate hairs (rarely nearly glabrous)
  Stems lax, scabrous on the angles; leaves mostly in 6's — 2. G. triflorum
  Stems erect, smooth; leaves mostly in 4's — 3. G. oreganum

1. G. cymosum Wieg. In bogs and wet thickets, infrequent, July to August. (H)
   Locs. In the bog near the cabin (882).

2. G. triflorum Michx. Moist soil in woods, infrequent, July to August. (H)
Locs. Edge of woods by first switchback (645) and in dense woods at 4200' along lookout road (905).

3. G. oreganum Britt. Open woods and disturbed areas, common, July to August. (H)
Locs. Near road fork at 4100' (821) and in open woods near cabin (695).

50. CAPRIFOLIACEAE

Shrubs or small trees; fruit fleshy, several seeded
Leaves simple — 1. Symphoricarpos
Leaves compound — 2. Sambucus
Trailing evergreen herbs; fruit dry, 1-seeded — 3. Linnaea

1. SYMPHORICARPOS Juss.

Corolla only slightly pubescent within; twigs glabrous — 1. S. albus
Corolla very woolly within; young twigs soft pubescent — 2. S. mollis

1. S. albus (L.) Blake. Woods and open moist slopes, infrequent, July to August. (Ph)
Locs. In woods at 4200' up trail to old lookout (904).

2. S. mollis Nutt. Moist thickets and woods, common, August. (Ch)
Locs. Near second switchback at 4400' (714).

2. SAMBUCUS L.

Inflorescence flat-topped; fruit black with a bloom; bark rough furrowed — 1. S. glauca

Inflorescence somewhat pyramidal; fruit scarlet; bark smooth — 2. S. callicarpa

1. S. glauca Nutt. Margins of woods, infrequent, July to September. (Ph)
Locs. Just above road fork at 4150' (918).

2. S. callicarpa Greene. Damp thickets, infrequent, June. (Ph)
Locs. Along road just below third road fork at 4100' (762).

3. LINNAEA (Gronov.) L.

1. L. borealis L. var. americana (Forbes) Rehder. Damp woods, common, July to September. (Ch)
   Locs. In woods just behind cabin (621).

51. VALERIANACEAE

1. VALERIANA (Tourn.) L.

1. V. sitchensis Bong var. Scouleri (Rydb.) Piper. Moist open woods, very abundant, June to September. (H)
   Locs. Open woods near the cabin (749).

52. CAMPANULACEAE

1. CAMPANULA (Tourn.) L.

1. C. Scouleri Hook. Moist soil in woods and margins of woods, infrequent, August to September. (H)
   Locs. Edge of woods just back of cabin (659).

53. COMPOSITAE

Flowers all ligulate
  Leaves all basal; at least the inner akenes beaked
    Peduncles bearing only one head
      Akenes spiny or tuberculate; involucral bracts in 2 sets — 1. Taraxacum

      Akenes not spiny; involucral bracts of 3 or 4 lengths — 2. Agoseris
    Penducles paniculately branching, i.e. bearing several heads — 3. Hypochaeris
  Leaves not all basal; none of the akenes beaked — 4. Hieracium

Flowers not all ligulate
  Ligulate flowers absent (see also Erigeron and Haplopappus)
    Pappus mainly or entirely of capillary or plumose bristles
      Cauline leaves reduced, scale-like; flower heads opening before the leaves — 5. Petasites

      Cauline leaves not scale-like; leaves coming out before the heads
        Leaves (at least the lower) opposite — 6. Arnica

Leaves all alternate
Plants typically dioecious; involucre campanulate to oblong
Pappus bristles more or less united at the base, those of the staminate flowers typically dilated at apex 7. Antennaria

Pappus bristles not united at base nor dilated at apex 8. Anaphalis
Plants monoecious (dioecious in Cirsium arvense); involucre ovoid, globose, cylindrical (rarely campanulate)
Receptacle densely and long bristly; akenes flattened; leaf segments spine-tipped 9. Cirsium
Receptacle not bristly; akenes cylindrical; leaf segments not spine-tipped 10. Senecio
Pappus of a thin crown of scales or minute teeth or wanting
Bracts equal and rigid, not spreading 11. Eriophyllum
Bracts not equal and rigid, often spreading
Heads small, paniculate; receptacle flat 12. Adenocaulon
Heads not paniculate; receptacle conic, columnar, or hemispheric
Receptacle naked; leaves dissected 13. Matricaria
Receptacle with chaffy bracts; leaves not dissected 14. Rudbeckia
Ligulate flowers present (rarely wanting in Erigeron & Haplopappus)
Pappus wanting
Involucre of only 4 or 5 bracts; leaves opposite 15. Hemizonella
Involucre of many bracts; leaves alternate (the lower sometimes opposite in Eriophyllum)
Receptacle naked
Involucral bracts essentially equal; herbage tomentose 11. Eriophyllum

Involucral bracts not equal; herbage not tomentose 16. Chrysanthemum
Receptacle with chaffy bracts
Heads in corymbiform clusters; akenes not angled 17. Achillea

Heads not in corymbiform clusters; akenes angled
Leaves pinnatifid or dissected
18. Anthemis
Leaves not pinnatifid or dissected
14. Rudbeckia
Pappus present
Pappus of thin paleae or minute teeth
11. Eriophyllum
Pappus of capillary bristles
Cauline leaves greatly reduced, scale-like; flower heads opening before the leaves
5. Petasites
Cauline leaves not scale-like; leaves opening before the flower heads
Leaves (at least the lower) opposite
Involucral bracts overlapping; akenes angled to nearly terete without a callus knob at base
19. Haplopappus
Involucral bracts not overlapping; akenes 5-10 ribbed with a callus knob at base
6. Arnica
Leaves alternate
Akenes somewhat compressed to much flattened
Involucral bracts in several ranks
20. Aster
Involucral bracts in 1 or 2 series nearly equal in length
21. Erigeron
Akenes cylindrical, spindle-shaped or angled but not compressed
Pappus of soft white bristles (cottony)
10. Senecio
Pappus of scabrous bristles
Pappus brownish or reddish; heads 1 - 2.5 cm. long (in ours except H. resinosus)
19. Haplopappus
Pappus whitish; leaves 4-7 mm. long
22. Solidago

1. TARAXACUM (Hal) Ludw.

1. T. officinalle L. Roadside, very rare, July. (H)
Locs. Observed a single plant July 10 in road just below third road fork at 4100'.

2. AGOSERIS Raf.

1. A. gracilens (Gray) Greene. Open areas, clay and rocky soils, infrequent, July to September. (H)
Locs. In a rock crevice on summit of Old Monument (857) and in cabin yard (675).

3. HYPOCHAERIS L.

1. H. radicata L. Meadows, open woods and roadsides, common, July to September. (H)
   Locs. In cabin yard (657).

4. HIERACIUM L.

Ligules yellow; leaves finely stellate-canescent; stem simple ..... 1. H. chapacanum

Ligules white; leaves loosely hirsute; stem often branched above ..... 2. H. albiflorum

1. H. chapacanum Zahn. Open grassy slopes or rocky soil, infrequent, July to September. (H)
   Locs. Dry southwest slope at 4650' just east of summit (701).

2. H. albiflorum Hook. Open woods and meadows, common, July to September. (H)
   Locs. Cabin yard (658).

5. PETASITES (Tourn.) Hill

1. P. speciosa (Nutt.) Piper. Damp shady woods below 4000', very rare, June. (Cr)
   Locs. At base of forest road 3600' (739).

6. ARNICA L.

1. A. latifolia Bong. In woods or on open clay soil, infrequent, July to September. (H)
   Locs. In a bog by the spring at 4400' (634), in moist open ground just below second switchback (604) and in open woods, dry soil in front of old cabin (812).

7. ANTENNARIA Gaertn.

Akenes puberulent, not glandular; leaves ovate to oblanceolate, glabrous above; involucre of staminate heads 5-6 mm. high ..... 1. A. racemosa

Akenes minutely glandular; leaves broadly spatulate to linear, lanate silky above (becoming nearly glabrous the second year); staminate involucres 7-8 mm. high ..... 2. A. concolor

1. A. racemosa Hook. Open area, rocky soil, infrequent, June to July. (Ch)
   Locs. On west slope at the summit (778).

2. A. concolor Piper. In open grassy areas, very rare, June to July. (Ch)
   Locs. At the summit (585).

8. ANAPHALIS DC.

1. A. margaritacea (L.) B. & H. var. occidentalis Greene. Open woods and thickets, common, July to September. (H)
   Locs. In cabin yard (682).

9. CIRSIUM (Tourn.) Hill

Heads, consisting of unisexual flowers, small obovoid to slender columnar — 1. C. arvense

Heads, consisting wholly of perfect flowers, larger, hemispheric
  Flowers pink or rose; involucral bracts narrow and sharply prickle-tipped — 2. C. lanceolatum

  Flowers cream-colored; involucral bracts widened above, tips dilated, fringed, and some with spines — 3. C. americanum

1. C. arvense (L.) Scop. Roadsides, clay soil, very rare, September. (Cr)
   Locs. Just below first switchback (974). Observed only one specimen, obviously an accidental introduction.

2. C. lanceolatum (L.) Scop. Roadsides, infrequent, September. (H)
   Locs. Roadside near road fork at 4100' (705).

3. C. americanum (Gray) Robins. Open woods and meadows, common, July to September. (H)
   Locs. In cabin yard (671).

10. SENECIO (Tourn.) L.

1. S. triangularis Hook. Open woods damp soil to bogs, common, June to September. (H)
   Locs. South slope just below the spring 4450' (632).

11. ERIOPHYLLUM Lag.

1. E. lanatum (Pursh.) Forbes. Open areas typically in dry rocky soil or grassy slopes, very abundant, June to September. (H)
Locs. At the summit (571).

12. ADENOCAULON Hook.

1. A. bicolor Hook. Moist woods, infrequent, July to August. (H)
Locs. At road fork (698).

13. MATRICARIA (Tourn.) L.

1. M. matricarioides (Less.) Porter. Roadbed, gravelly soil, very rare, August. (Th)
Locs. At road fork 4100' (941).

14. RUDBECKIA L.

1. R. occidentalis Nutt. Moist thickets, infrequent, July to August. (Cr)
Locs. Between cabin and road fork along roadside in edge at Alnus sinuata thicket (664).

15. HEMIZONELLA Gray

1. H. minima Gray. Dry gravelly soil in open areas, infrequent, June to August. (Th)
Locs. At the summit (594).

16. CHRYSANTHEMUM L.

1. C. Leucanthemum L. var. pinnatifidum Lec. & Lam. Meadows and open woods, infrequent September. (H)
Locs. At 4300' along trail up to Old Monument (943).

17. ACHILLEA L.

1. A. lanulosa Nutt. Dry open woods and exposed areas in clay and rocky soils, common, July to September. (H)
Locs. At summit on a grassy south slope (589).

18. ANTHEMIS L.

1. A. cotula L. Roadsides, very rare, September. (Th)
Locs. Roadbed at third road fork 4100' (975).

19. HAPLOPAPPUS Cass.

1. H. Hallii Gray. Open areas in dry gravelly soil, infrequent, September. (H)
   Locs. On a southeast slope near site of old lookout (706).

20. ASTER L.

Leaves more or less white tomentose below; involucral bracts not largely herbaceous — 1. A. ledophyllus

Leaves not tomentose below; involucral bracts largely herbaceous
- Involucre distinctly glandular — 2. A. modestus
- Involucre not glandular — 3. A. radulinus

1. A. ledophyllus Gray. Meadows and moist open areas, infrequent, August to September. (H)
   Locs. East exposure near the summit (973).

2. A. modestus Lindl. Thicket margins and moist open slopes, common, September. (H)
   Locs. Open south slope at 4400' (633).

3. A. radulinus Gray. Dry gravelly soil, open area, very rare, September. (H)
   Locs. East slope of North Ridge (990).

21. ERIGERON L.

1. E. Aliceae How. Open woods and moist meadows, common, July to September. (H)
   Locs. In cabin yard (611 & 652).

22. SOLIDAGO L.

1. S. lepida DC. var. caurina (Piper) Peck. Moist meadows, infrequent, August to September. (H)
   Locs. In cabin yard (673).

PERIODICITY DATA FOR 1948

An attempt was made to note at intervals of approximately two weeks all the species which were in flower. The results are tabulated on the pages which follow. Several of the grasses, sedges, and rushes are not included in the tables because little or no data were obtained on them; however, the flowering periods of 224 species for the summer of 1948 were obtained and are included in this study.

It will be noted from figure 18 that there were two peaks as regards the number of species in flower. The first was in late June and the second during the latter part of July when a total of 111 species were observed in flower. The dates of flowering of a given species showed some differences with different altitudes; but in no case, except for that occasioned by a cover of snow, were these differences pronounced. The sudden drop in number of species in flower on October 2 can be attributed largely to severe frosts which occurred just after September 29.

Montia sibirica which was found in flower at every check date from May 24 to September 29 had the longest continuous flowering period. Dicentra formosa, Erysimum asperum, Tiarella unifoliata and Microsteris gracilis

bloomed continuously from June 17 to September 13. Two species, Viola glabella and Gilia capitata, are noteworthy having two or three flowering periods during a single season.

In the case of some of the grasses and sedges, it was quite obvious from the condition of the anthers that the species had been in flower a few days prior to the dates they were collected. That estimated period is referred to as the projected date and is indicated by a broken line in the tables.

TABLE 6

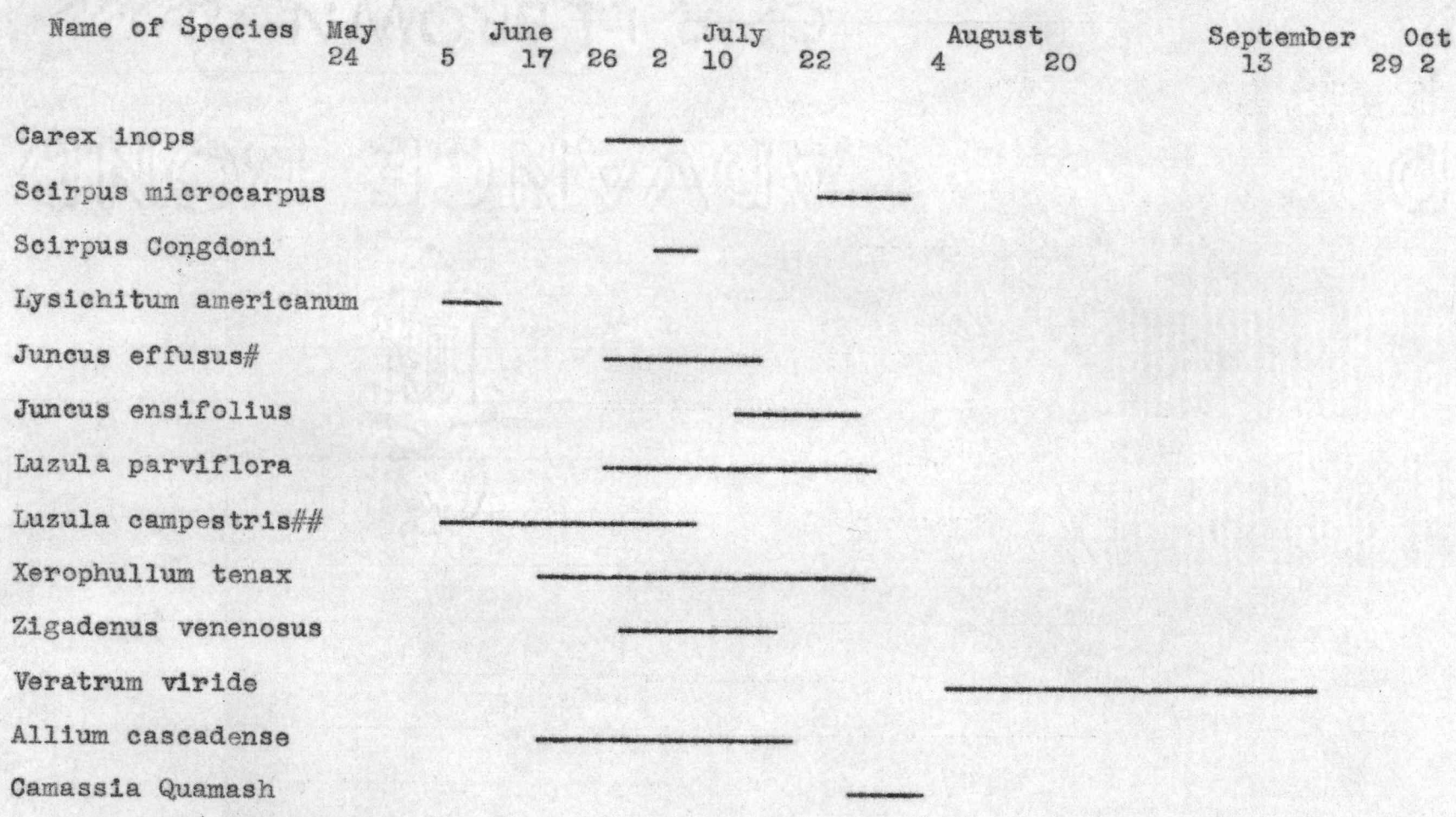
FLOWERING PERIODS OF THE SPECIES

Name of Species	May 24	5	June 17	26	July 2	10	22	August 4	20	September 13	29	Oct 2
Melica Smithii							———	———				
Bromus marginatus								------				
Pleuropogon refractus						—-						
Poa pratensis								------	——			
Festuca rubra				———	———	———						
Festuca subulata								-----				
Cinna latifolia								------	——			
Agrostis diegoensis					———	———						
Carex Kelloggii						——						
Carex festivella					———	———	———					
Carex Mertensii				———	———	———	———	———	———	———	———	———

——— indicates flowering period actually observed

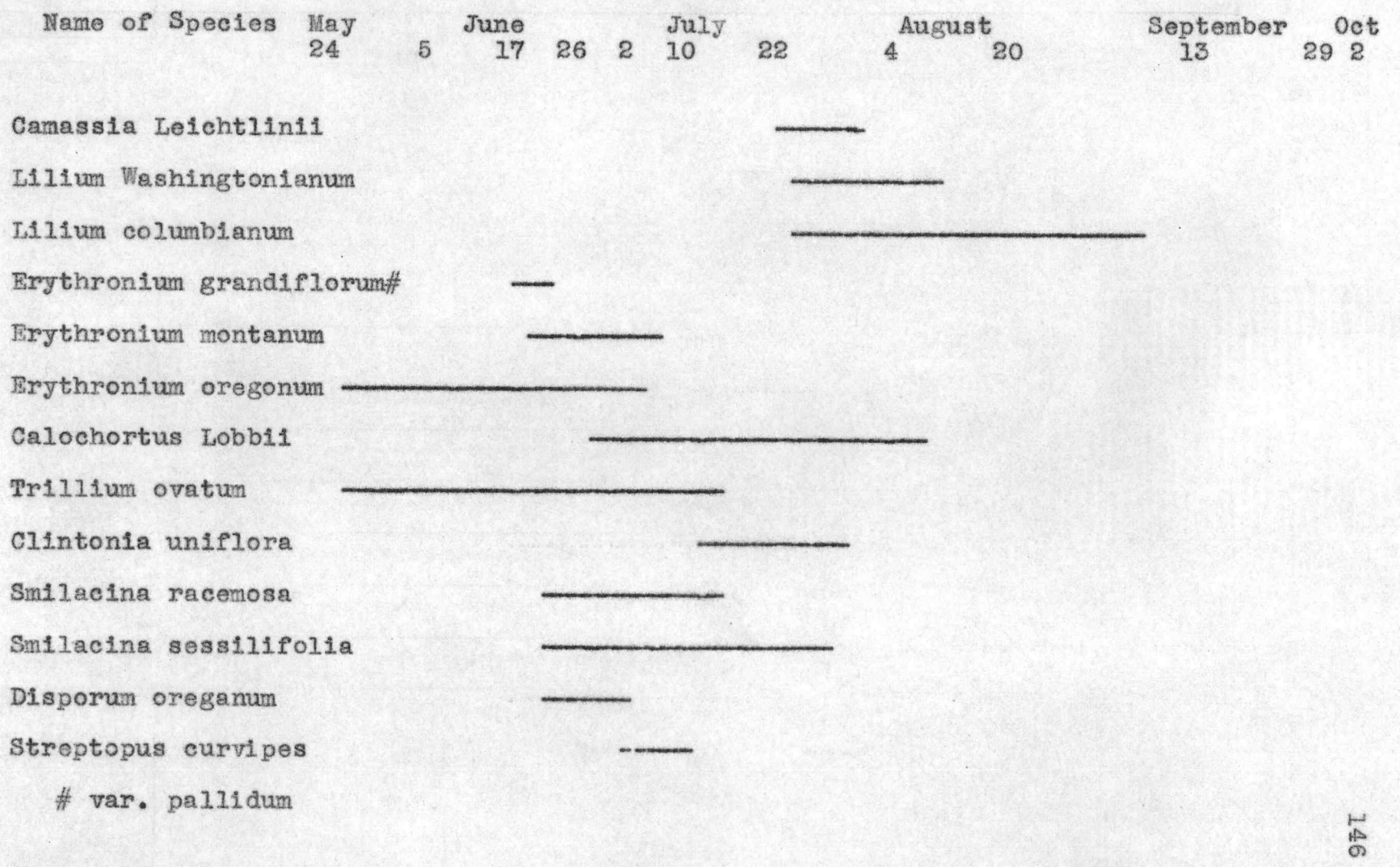
------ indicates projected flowering period

TABLE 6 (Continued)



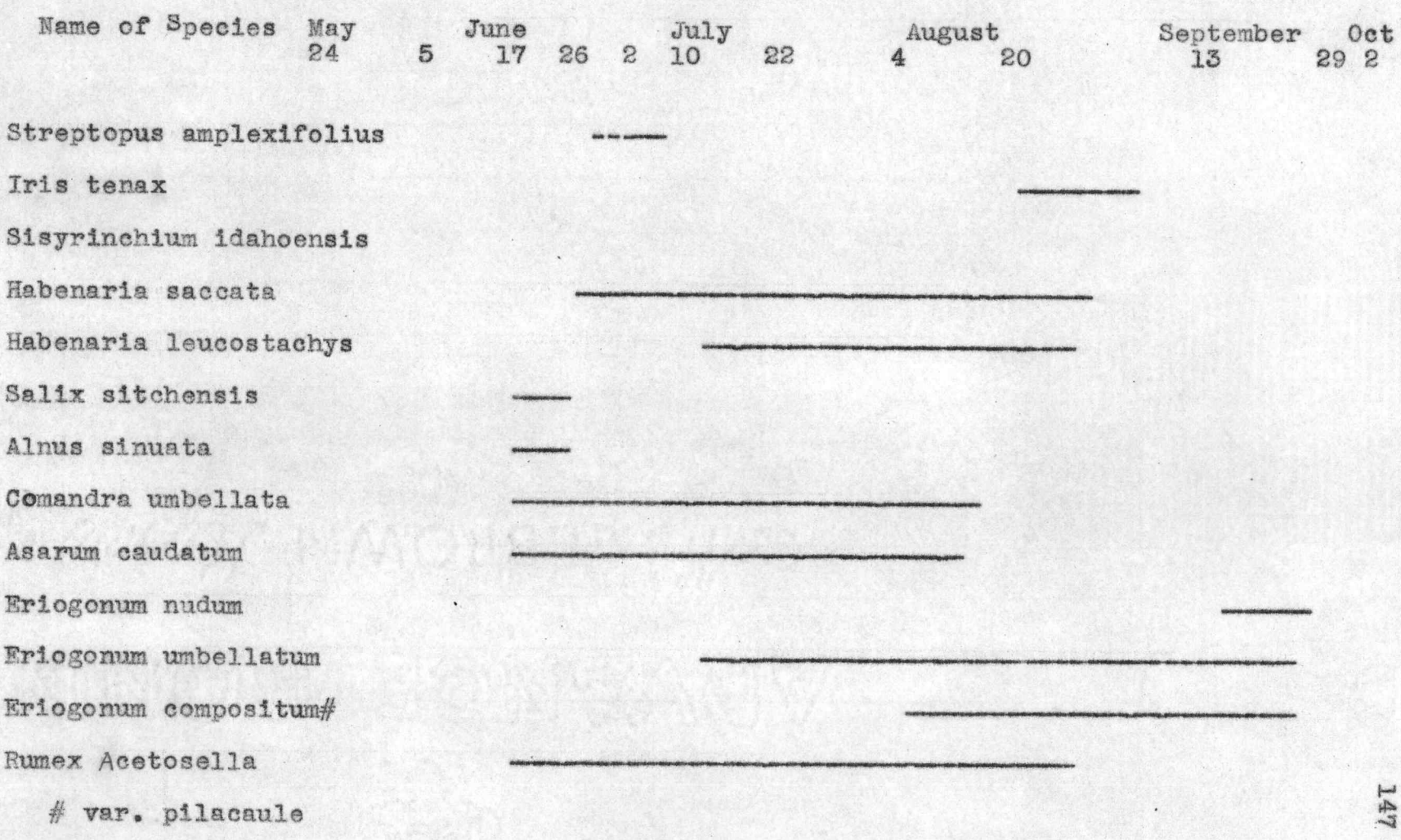
var. pacifica ## var. multiflora

TABLE 6 (Continued)



var. pallidum

TABLE 6 (Continued)



var. pilacaule

TABLE 6 (Continued)

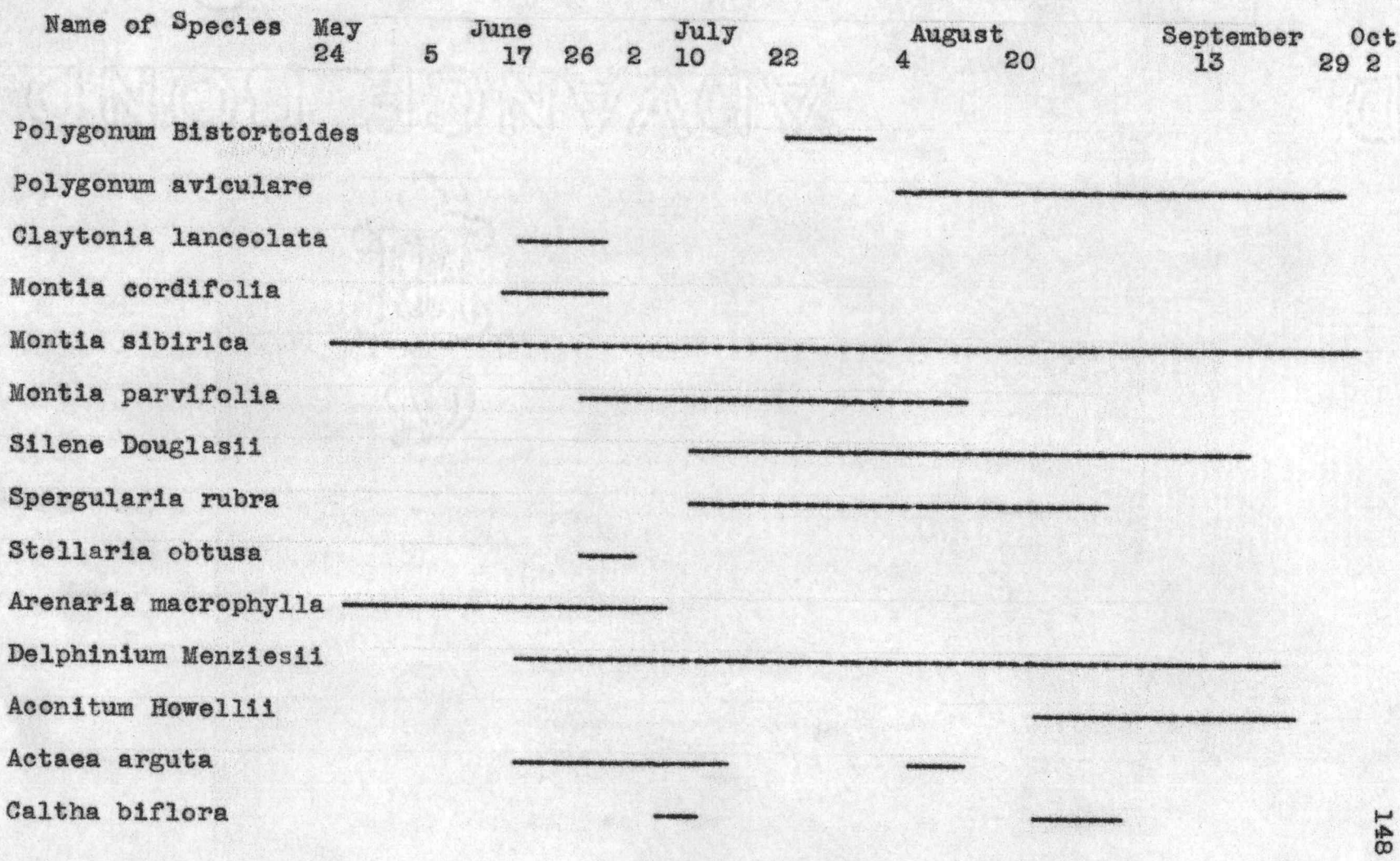
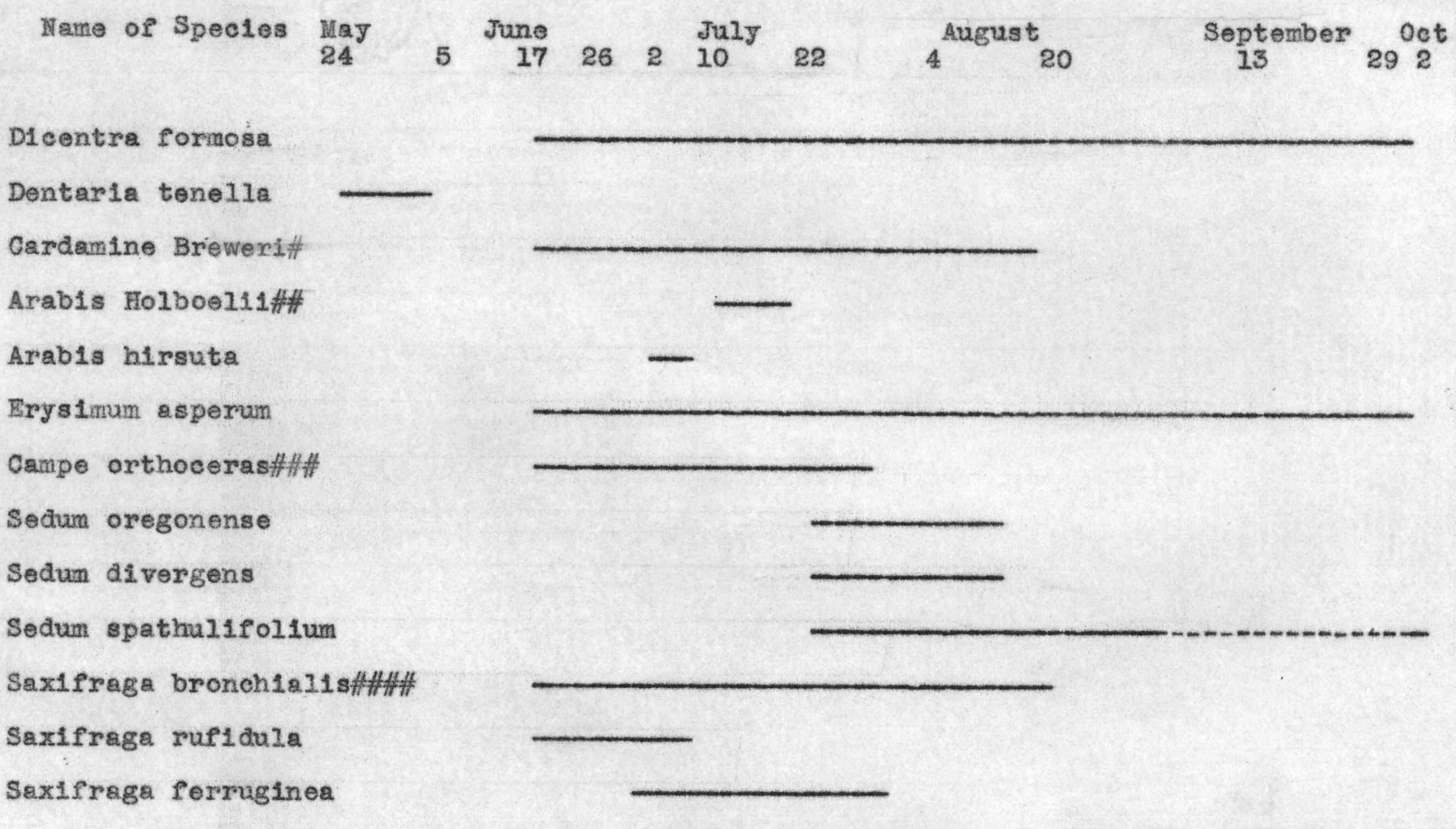


TABLE 6 (Continued)

Name of Species	May 24	5	June 17	26	2	July 10	22	August 4	20	September 13	29	Oct 2
Trautvetteria grandis			—									
Anemone deltoidea						——						
Anemone Lyallii	——	——	——									
Anemone oregana			——									
Thalictrum occidentale			——									
Aquilegia formosa			——	——	——	——	——	——	——	——		
Ranunculus Populago			——	——	——	——	——	——	——	——		
Ranunculus uncinatus#						——	——					
Ranunculus orthorhynchus						—						
Achlys triphylla			——									
Vancouveria hexandra								—				
Berberis Aquifolia		——	——									
Berberis nervosa		——										

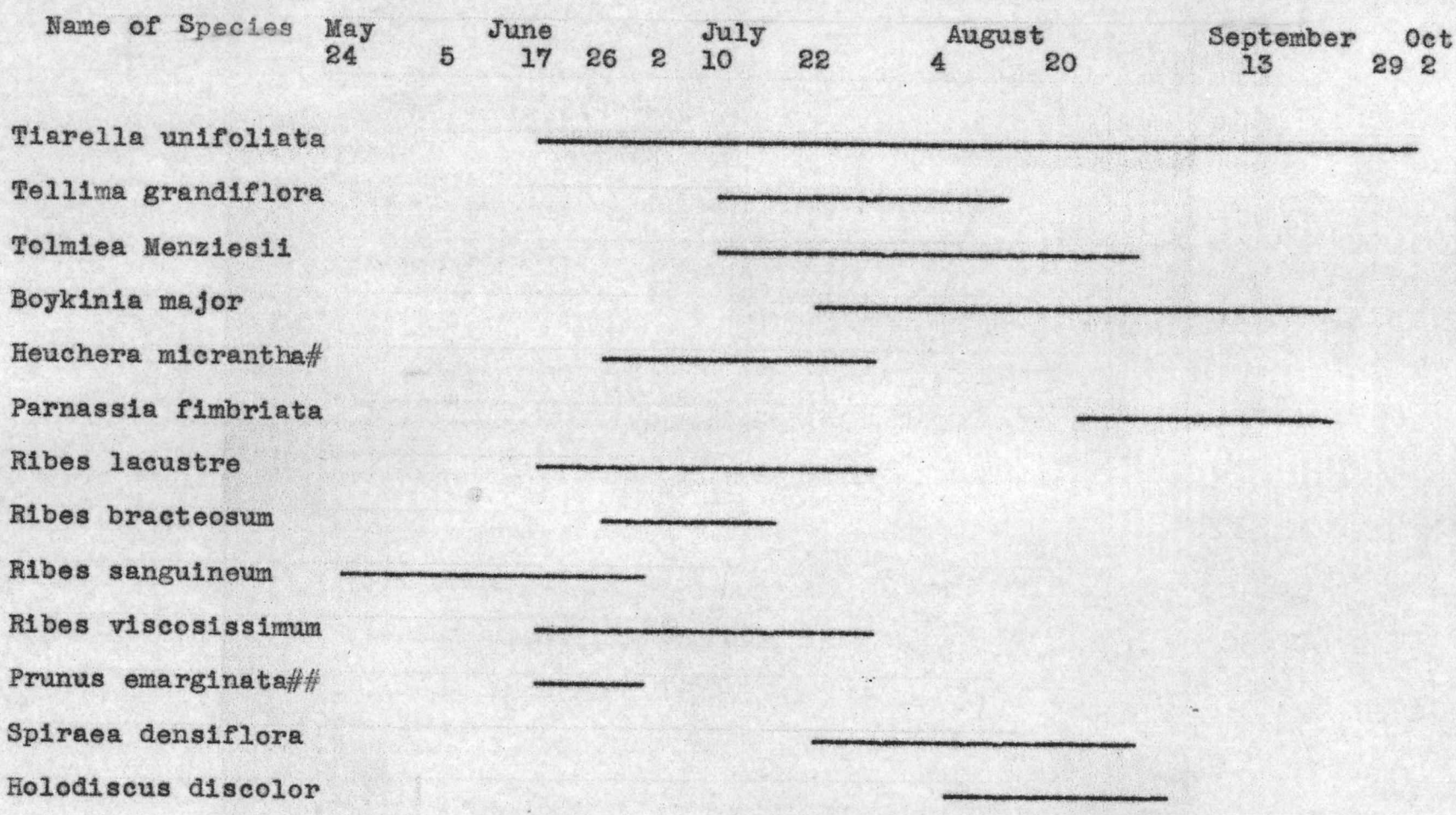
var. parviflorus

TABLE 6 (Continued)



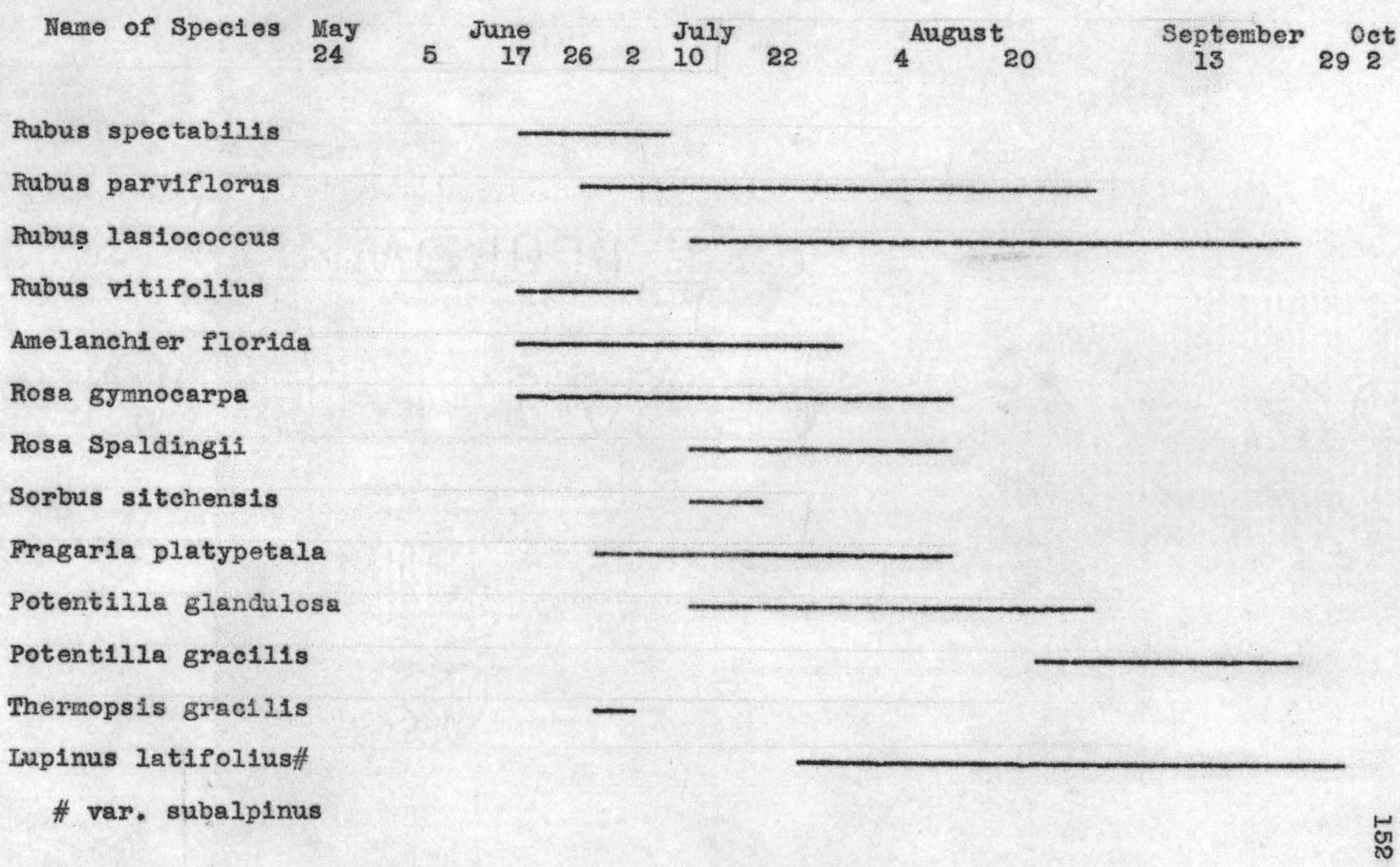
var. orbicularis ## var. secunda ### var. dolichocarpa #### var. austromontana

TABLE 6 (Continued)



var. pacifica ## var. erecta

TABLE 6 (Continued)



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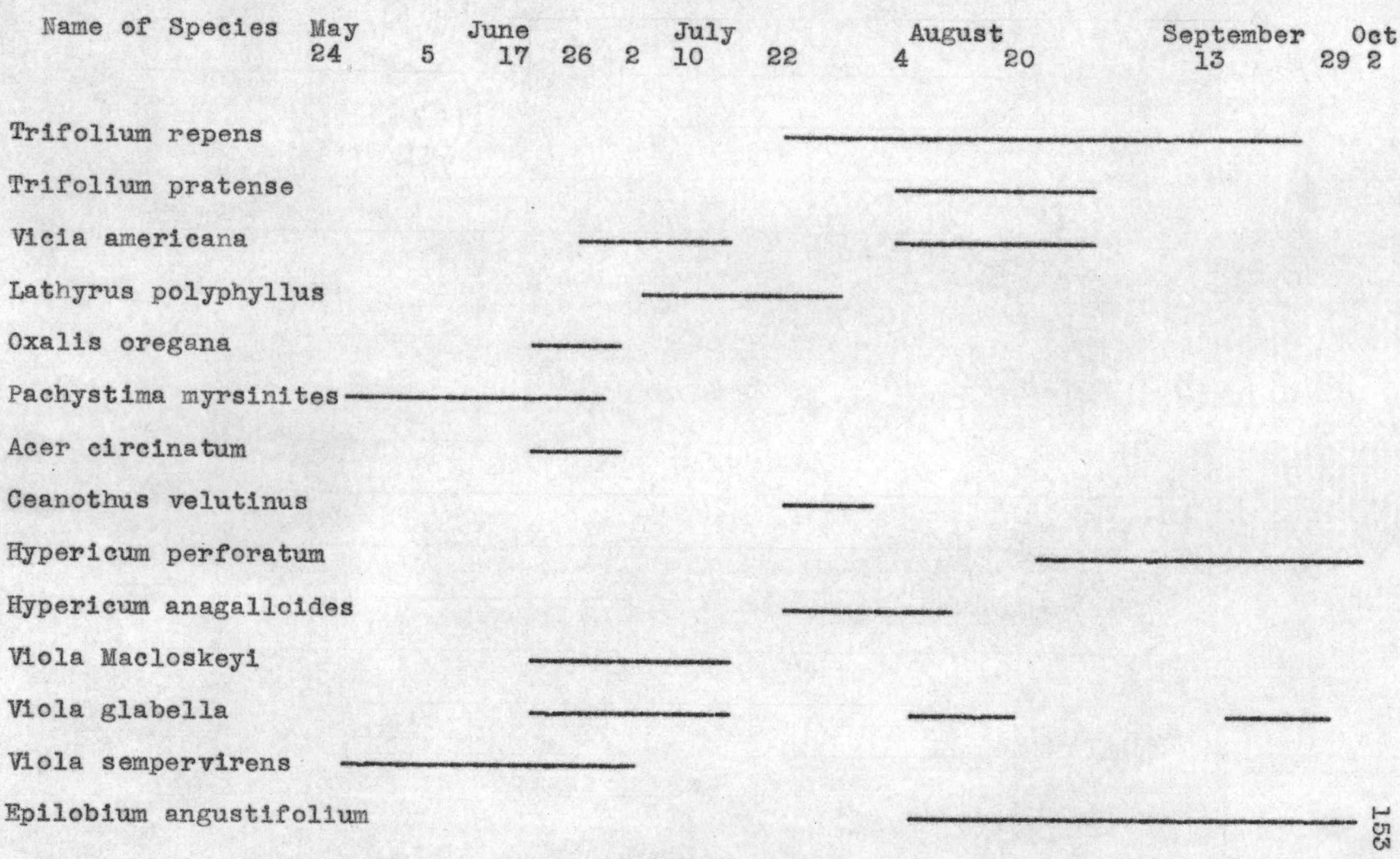
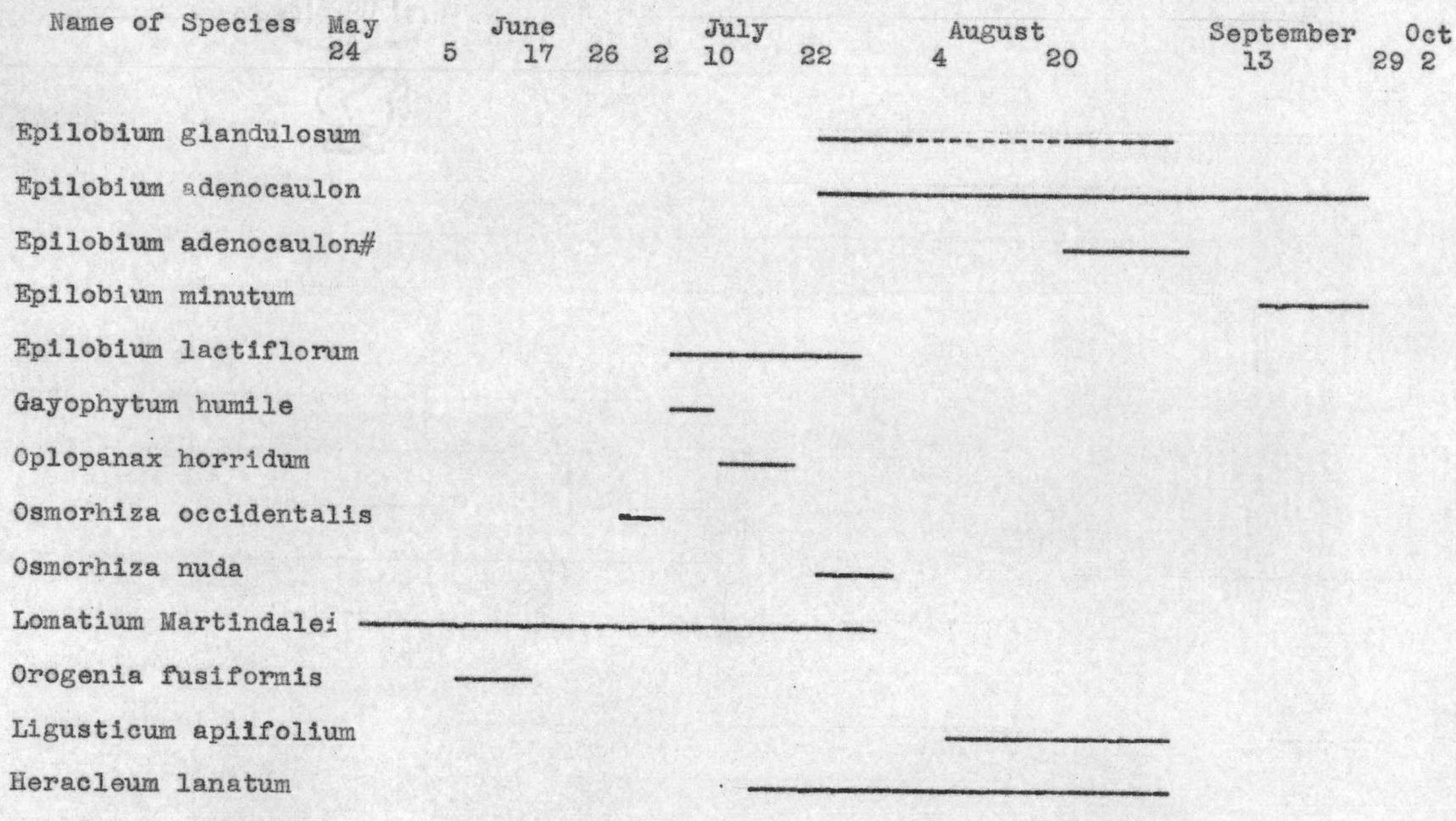


TABLE 6 (Continued)

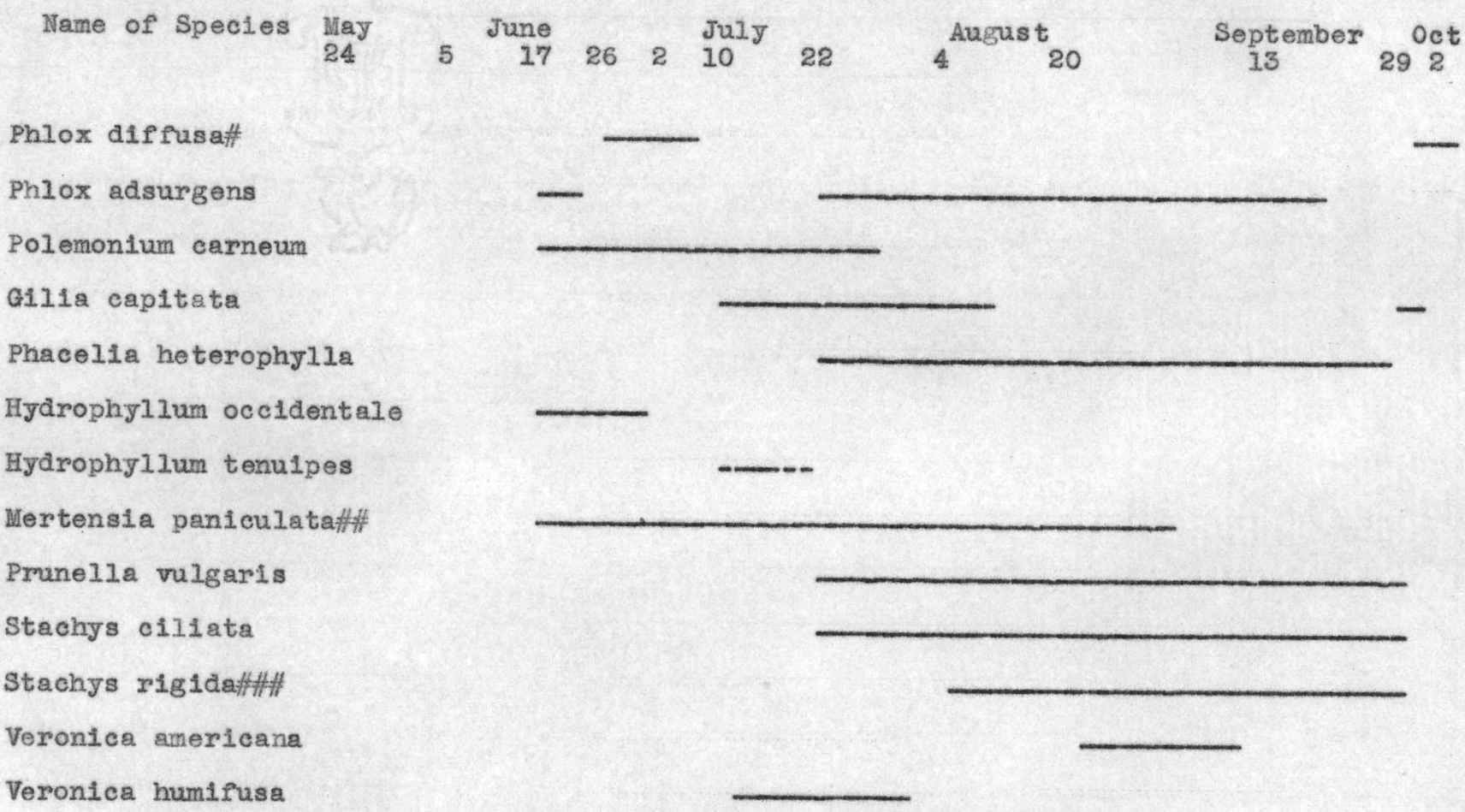


var. perplexans

TABLE 6 (Continued)

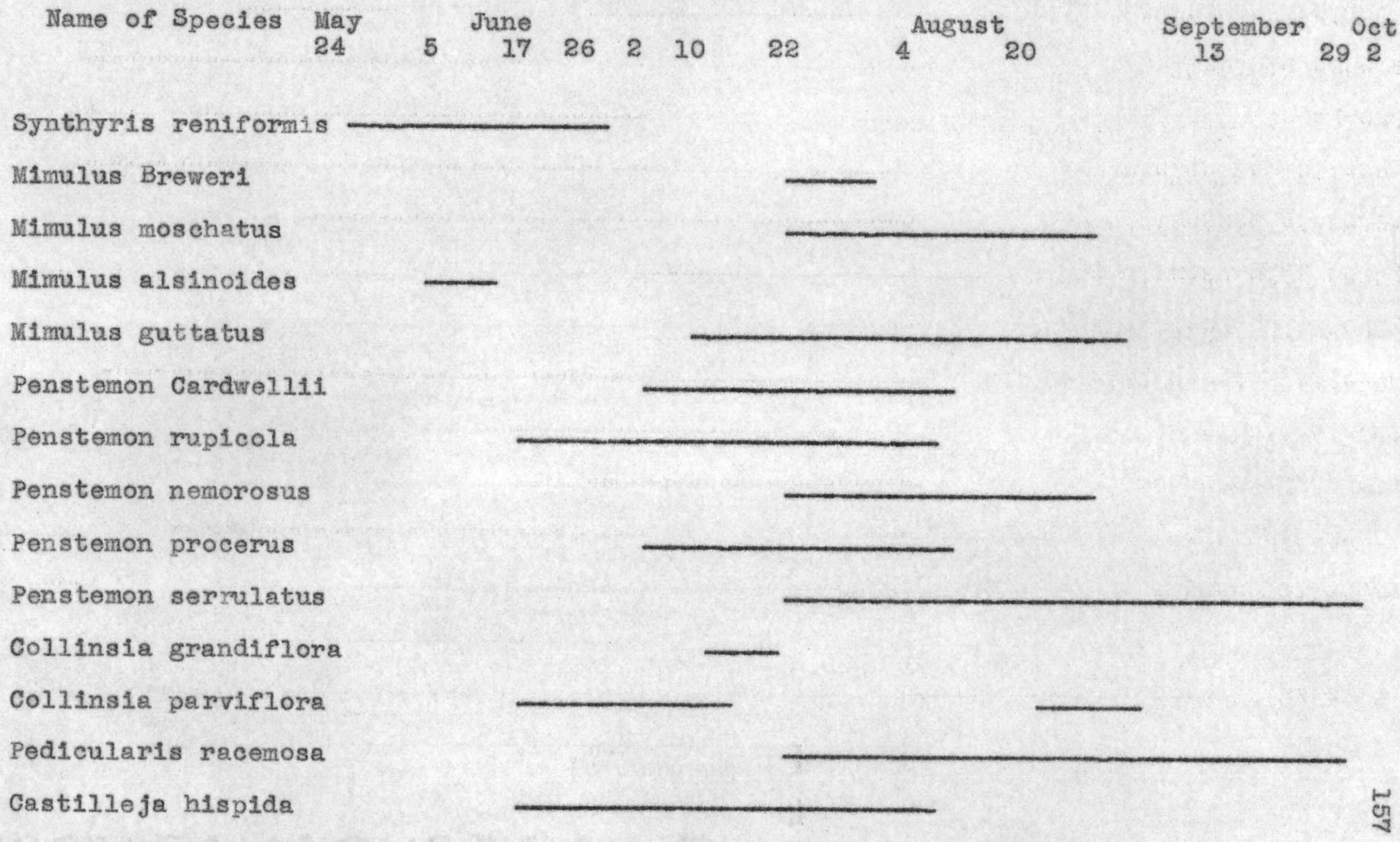
Name of Species	May 24	5	June 17	26	July 2	10	22	August 4	20	September 13	29	Oct 2
Cornus canadensis			———	———	———	———	———	———	———			
Pleuricospora fimbriolata												—
Pyrola dentata				———	———	———	———					
Menziesia ferruginea				—	—							
Rhododendron macrophyllum			———	———	———	———						
Arctostaphylos columbiana												
Arctostaphylos nevadensis					—	—						
Arctostaphylos Uva-ursi			———	———	———							
Vaccinium membranaceum			———	———								
Vaccinium ovalifolium			—	—								
Dodecatheon Jeffryi			———	———	———							
Trientalis latifolia				———	———	———	———					
Microsteris gracilis			———	———	———	———	———	———	———	———	———	———

TABLE 6 (Continued)



var. longistylis ## var. borealis ### var. rivularis

TABLE 6 (Continued)



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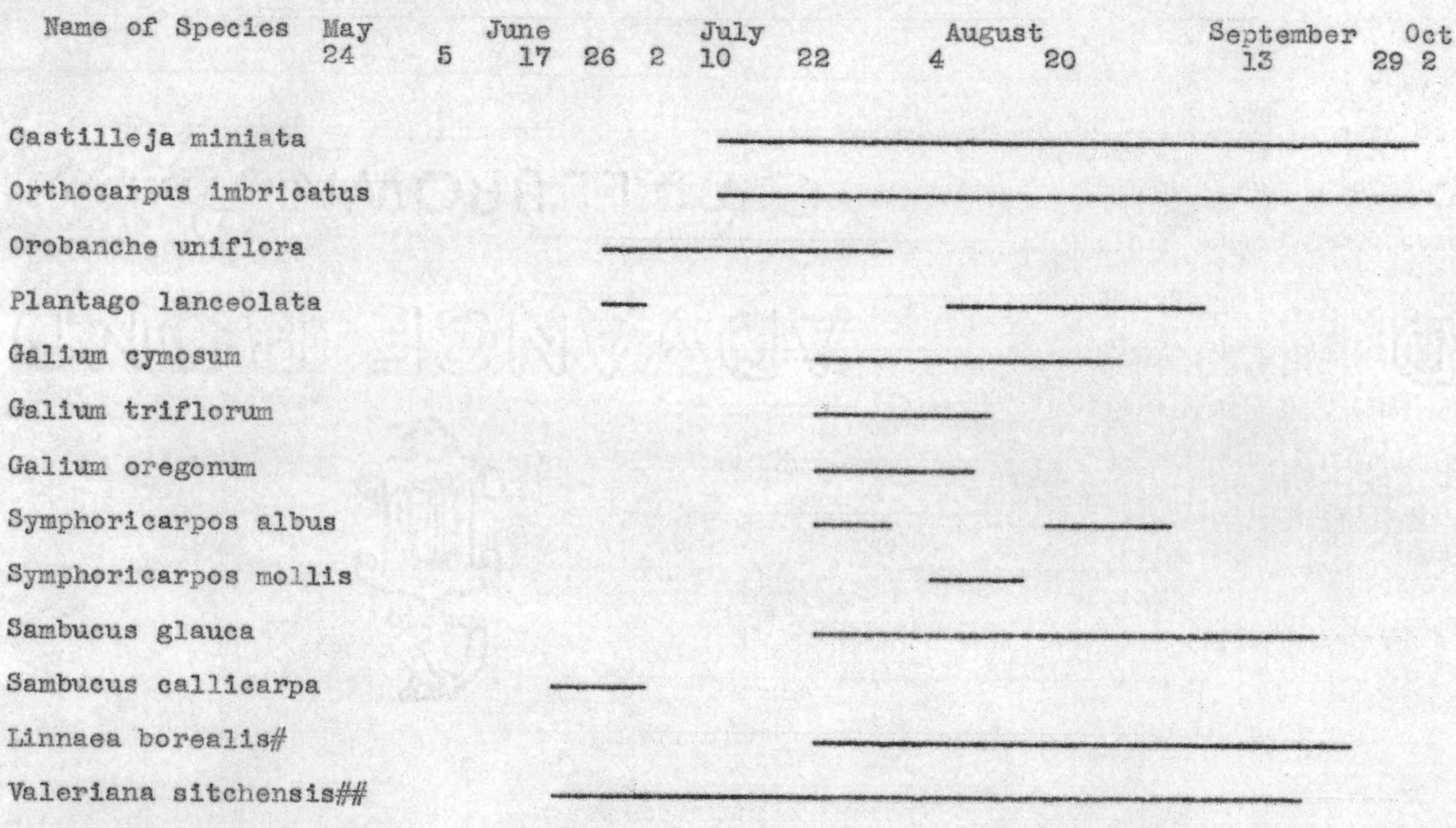
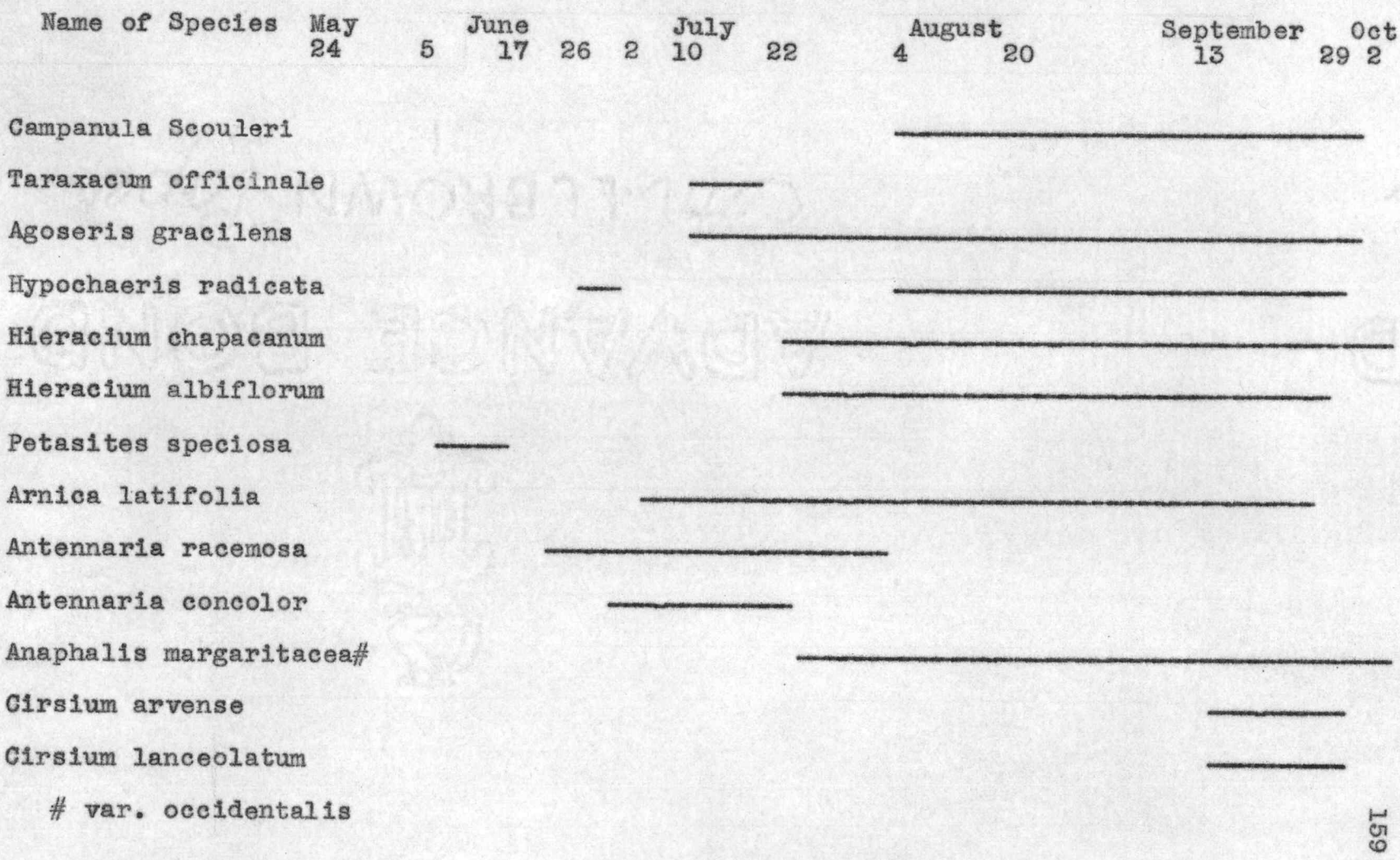


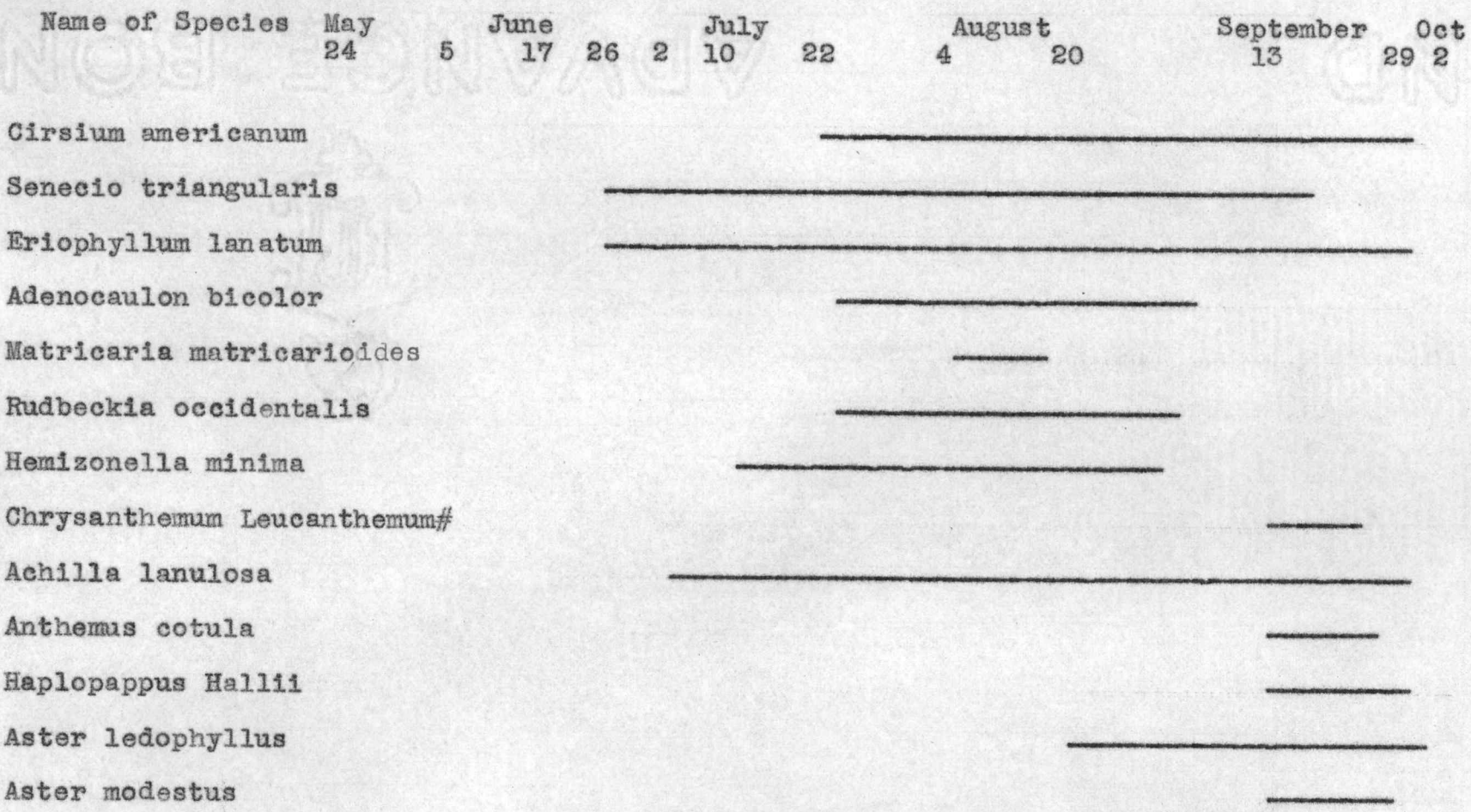
var. americana ## var. Scouleri

TABLE 6 (Continued)



var. occidentalis

TABLE 6 (Continued)



var. pinnatifidum

TABLE 6 (Continued)

Name of Species	May 24	June 5	June 17	June 26	July 2	July 10	July 22	August 4	August 20	September 13	September 29	Oct 2
Aster radulinus												—
Erigeron Aliceae							———	———	———	———	———	
Solidago lepida#									———	———	———	

var. caurina

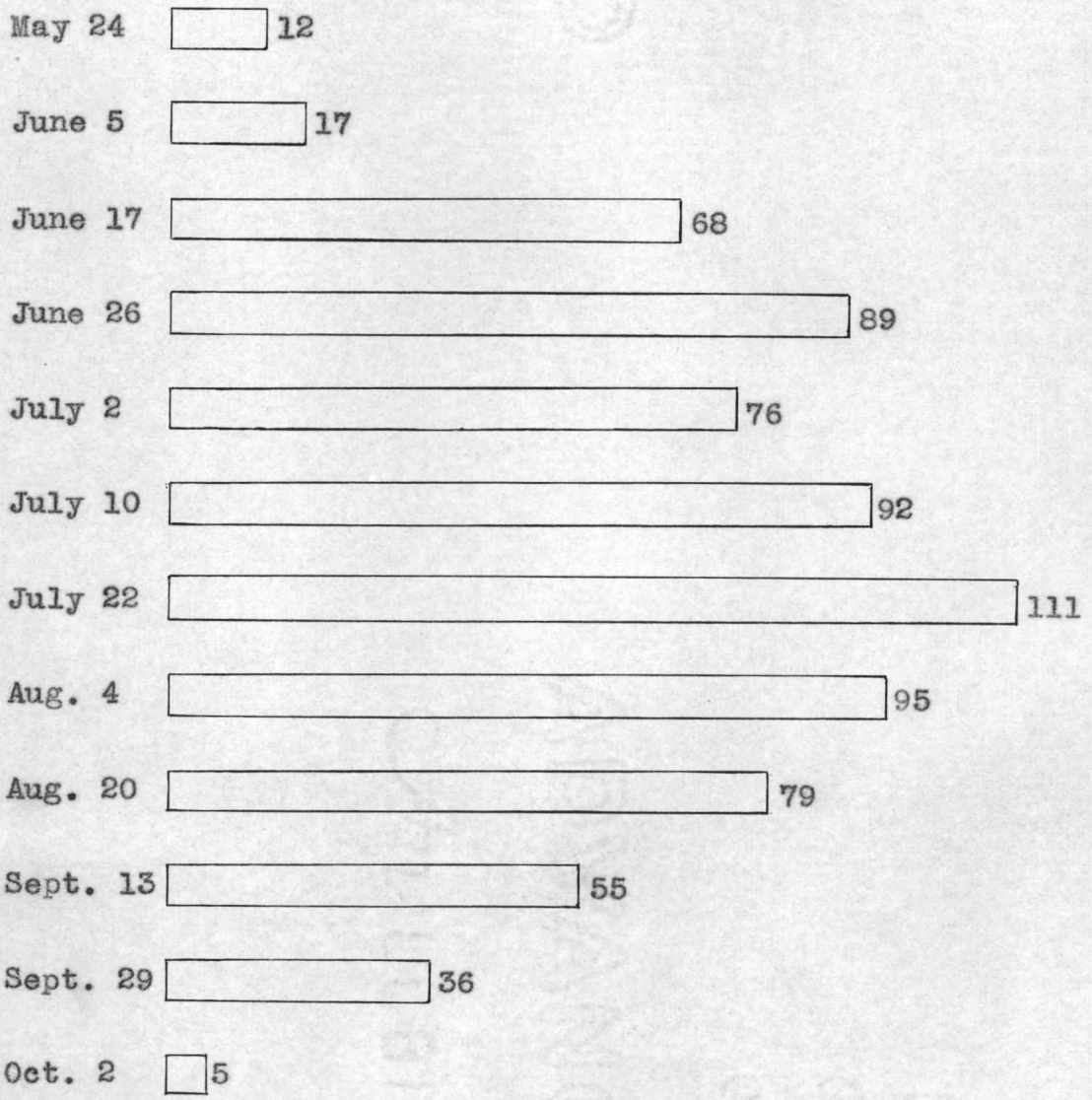


Fig. 18 Graph Showing the Number of Species in Flower at the Check Dates

SUMMARY

Monument Peak is located on the west flank of the Oregon Cascades in northern Linn County. The area lies within the cedar-hemlock forest. The climax dominants above 4000' are Tsuga heterophylla, Abies amabilis, and A. procera. Thuja plicata is restricted to elevations below 4000', while Douglas fir, largely confined to dry rocky soil and regions of recent burns, is a seral dominant. Mountain hemlock, found sparingly at the summit, should be regarded as co-dominant and occurs here at the extreme lower limits of its range.

Collections over two summers (1947 and 1948) from 3700' to the summit (4700') yielded 280 species and varieties of vascular plants. Above 4000' the flora is quite typically Canadian with a few characteristic Hudsonian species such as Chamaecyparis nootkatensis and Tsuga Mertensiana. The climate is hemicryptophytic. The biological spectrum corresponds very closely to those of the Canadian zones of Mt. Rainier and the Olympic Peninsula.

Four distinct plant communities are found in the region: a rock-fell, a coniferous forest, a deciduous shrub, and a bog-marsh community. On dry, rocky west slopes six stages in xerarch succession are recognizable. Quadrat studies revealed three important seral dominants;

Eriophyllum lanatum, Rhacomitrium lanuginosum, and Festuca rubra, which comprise important components in two different associes of the rock-fell community. The stages in hydrarch succession in the bog-marsh are less distinct, but certain associes were determined. A relatively stable Alnus sinuata-Acer circinatum associes covers a large southwest slope. There is evidence that the community has existed in the area for quite a long time and is apparently holding its own against the climax dominants of the region. The persistence of this community is to be explained in part by a time-place factor. These species apparently became established after some catastrophe had destroyed the climax forest. Seepage keeps the soil very wet promoting thick, rank growth of the seral dominants and thus helps prevent invasion by the climax dominants.

A single specimen of dwarfed Quercus Garryana found at 4000' doubtless is a relict from a dry period shown by various investigators to have occurred between 8000 and 4000 years ago. Alaska cedar is likewise to be regarded as a relict exhibiting, as it does, a discontinuous distribution. There is some evidence that one clump of this species has arisen through suckering from a parent tree.

Thirty-five per cent of the species found on Monument Peak are known to be of boreal origin, and it is likely that quite a number of additional species migrated to the

area from the north. A small number of the species probably belong to the Mexican element while a third group is believed to have originated in the area east of the Cascades and the Great Basin. One or two endemic species are found in the Monument Peak area and several forms with discontinuous distribution are represented here. Adventive species account for 6.8 per cent of the flora.

The study revealed new ranges for 18 species, 15 of which, according to the literature, were not formerly known to occur west of the Cascade divide. It is held that most of these have probably migrated across the Cascades within recent times.

The flowering periods of 224 species were recorded for the summer of 1948. July 22 saw the greatest number of species in bloom---a total of 111.

The taxonomic phase of the study opened up some new problems in this field which will require further investigation. It is believed, for example, that additional study may yield new and valuable diagnostic characters for one section of Carex if not actually a new species.

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