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Dear Sir:

The attached report entitled FLORISTIC DESCRIPTIONS OF COVER TYPES IN WELLS GRAY PARK is submitted herewith for your approval.

Yours very truly,

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FLORISTIC DESCRIPTIONS OF COVER TYPES IN WELLS GRAY PARK

by
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1957

Wildlife Section Report No. 57 Project No. WG 11

British Columbia Forest Service
Parks and Recreation Division
H.G. McWilliams, Forester

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FLORISTIC DESCRIPTIONS OF COVER TYPES IN WELLS GRAY PARK

I. INTRODUCTION

In the summer of 1955, a project was started to cover-type map the burn areas important to moose winter range in Wells Gray Provincial Park. (see Wildlife Report No. 55). Aerial photographs were used as the basis of the 1955 project. Ground checks were done by the author and an assistant in 1956.

The ground checking work provided a good opportunity to describe the plant cover in general. Detailed floristic descriptions were completed in the field. This work was carried beyond the burns to include nearby conifer stands as well as sub-alpine conifer and meadow country. The main associations or types encountered were described. Areas given little or no attention included hemlock forests, dense alpine fire - Engelmann spruce type, and high alpine areas.

In brief, the aim of the study, besides serving as a check of the photo interpretation, was:

- (1) to get a detailed floristic description of the cover type,
- (2) to find the plants most characteristic of each cover type, and
- (3) to find characteristics of soil, site, etc., of the respective cover types.

Also, a modest plant collection and check list were started in connection with this study. This was given to the Provincial Museum and may be referred to there.

Limited references enabled the author to key out some plants in the field. Those not identified were collected and given a code number. Some of these have been identified by the BC Provincial Botanist, Dr. Szezwiniski, who will complete the identification work at a later date.

For field identification, the following references were used:

- (1) Lyons, C.P. Trees, Shrubs, and Flowers to Know in BC (2nd Edition)
- (2) Peck, M. A Manual to the Higher Plants of Oregon
- (3) Henry, J.K. Flora of Southern British Columbia and Vancouver Island

In many of the more difficult genera such as *Salix*, *Antennaria*, etc., only the generic name was used. Grasses were referred to as Gramineae. Mosses and lichens, although attempted, were incompletely dealt with. The author had no reference with moss or lichen keys.

II. METHOD

A. Sample Selection

Photograph types were checked with ground types by traveling to individual types and comparing photo type with ground vegetation. Field notes for this study were made at the same time,

Small sections of types were taken as samples and these were described in detail. The samples were chosen at random far enough into the type to eliminate the effect of "edge". The size of sample areas varied, but were usually at least twenty yards in diameter. The object was to include most of the plants present in the type.

B. Field Notes

The field notes included: a list of all of the plants present on the sample area; age - height records of dominant tree species to determine the site index; soil moisture; height of the tree canopy; elevation; and the species of snags, where present.

1. Plant list: All plants on the sample area were listed, grouping trees, shrubs, herbs, and mosses and lichens, separately.

Species were valued as to abundance and vigor. The method used was as follows: If a species was very abundant and vigorous in relation to surrounding vegetation, it was given a rating of three. Plants in moderate abundance, or in local concentrated patches, were given a rating value of two. Plants represented only by scattered individuals were valued at one. Those very scarce or obviously dying out were valued at one-half. Thus totals of resulting values for any one species in a type would indicate its relative abundance and vigor. A more detailed method than the above has been described by Kuchler (1955) and should be referred to in any further study of this kind. Kuchler used a very good method for detailed descriptions of small areas.

2. Site Records: The site index classification used is meant to be only a standard for comparison of cover types.

The method of site determination was as follows. If present, one or two dominant or co-dominant conifers were chosen on each sample area. These trees were aged at one foot above ground level using a standard ten inch increment borer. Three years were allowed for the one foot growth. The dbh was taken using a diameter tape. Height was estimated if in young, immature stands, and was measured with a tape and Abney if in coniferous stands that were established before the 1926 burn. The site index (height at age of 100 years) was calculated assuming that the tree would continue to grow at the same rate as it had previous to measurement. It is felt that the actual site index of the young, immature stands is lower than indicated because competition in later years will probably reduce growth rate.

3. Height of Canopy: On each area visited, the general height of the canopy was estimated. These data are most useful for photo type recognition in the mapping project.

4. Soil Moisture: The soil moisture in each sample was recorded. With increasing soil moisture, the quantitative terms: dry, moist, damp, wet, were used.

5. Snags Present: It was hoped that some record of previous cover could be obtained. An attempt was made to recognize the snag species on the burn, but the data were very incomplete.

Therefore, only generalizations can be drawn on this subject. In another study of this type, it would be advisable, if at all possible, to get an accurate description of the previous timber.

6. **Elevation:** Estimates of the elevations of samples were included in the field notes.

PART I

A. Low Elevation Floristic Descriptions with Type Lists

1. Coniferous Type: Most samples of the coniferous type were taken east of the Clearwater River between Hemp Creek and the John Ray Farm. One sample, in a fir stand, was made on the west side of the Clearwater River.

The site index of the conifer stands varies from 60 to 150, with the average being 110.

The average height of the canopy is 90 feet.

There are few lodgepole pine stands in the park. This does not appear to be the main sub-climax species as in much of the drier interior of British Columbia. The most widespread sub-climax tupe in the park appears to be the Douglas fir - aspen forest. Fir and aspen grow vigorously, but are quite soon crowded out by the more tolerant cedar or hemlock. Engelmann spruce regenerates in some local areas, but is quite heavily infected by Engelmann spruce tip weevils. Engelmann spruce stands are usually succeeded by cedar. The climax forest is usually pure cedar or hemlock.

A study and evaluation of coniferous types in the park could be a work in itself, requiring individual consideration of types and sites. Reference should be made to the BC Forest Service inventory data.

All mature coniferous types were grouped together. Therefore, typical understory plants are difficult to find. However, some plants not found to any great extent in other types, *Tiarella* spp. and plants of the Liliaceae group, as well as the ferns, are common under conifer cover.

Conifer Type List (all type lists are given in order of abundance, from greatest to least.)

(Complete species list in Appendix I a.)

1. *Thuja plicata* - red cedar
2. *Pseudotsuga taxifolia* - Douglas fir
3. *Pachystima myrsinitis* - false box
4. *Picea engelmannii* - Engelmann spruce
5. *Linnaea borealis* - twinflower
6. *Aralia nudicaulis* - sarsaparilla
7. *Rubus parviflorus* - thimbleberry
8. *Tsuga heterophylla* - western hemlock
9. *Cornus canadensis* - ground dogwood
10. *Betula papyrifera* - paper birch
11. *Tiarella unifoliata* - foam flower
12. *Disporum oregonum* - Oregon fairy bell
13. *Clintonia uniflora* - queen's cup
14. *Alnus tenuifolia* - alder
15. *Populus trichocarpa* - cottonwood
16. *Abies lasiocarpa* - alpine fir
17. *Corylus californica* - hazel
18. *Smilacina stellata* - star-flowered Solomon's seal

19. *Peramium decipiens* - rattlesnake plantain

Ferns: *Dryopteris Linnaeana* - *Gymnocarpium dryopteris*
Athyrium filix - femine

2. Regeneration Type: The regeneration type, which usually grows on moist soil, has an average site index of 140. (Based on Douglas fir.)

Douglas fir and lodgepole pine are the major species of coniferous regeneration. Areas of regeneration are local and almost exclusively a result of proximity to available seed. Over most of the burn, regeneration is dense near mature timber but thins out toward the centres of the burned areas.

The growth rate is good but much regeneration is not dense enough to self-prune. Thus many trees take the form of wolf trees. Outstanding fir regeneration was found in the west side of MacLeod Hill and down through much of the Blackwater area. If multiple use is to be considered for the park, these areas should be immediately considered for thinning and pruning operations.

The dense stands of lodgepole pine are most common in the southern end of the park. Throughout most of the burn, pine and fir are scattered in almost equal amounts. Because pine is probably more abundant in the park now, than before the fire, it is possible that further fires would result in a greater preponderance of pine and a decrease in fir.

The average height of the canopy of regeneration is 40 feet.

Regeneration Type List (Complete species list in Appendix I b.)

1. *Pinus contorta*
2. *Pseudotsuga taxifolia*
3. *Salix* spp.
4. *Pachystima myrsinitos*
5. *Shepherdia canadensis* - soopallalie
6. *Linnaea borealis* - twinflower
7. *Cornus canadensis* - ground dogwood
8. *Alnus sinuata* - slide alder
9. *Chimaphila umbellata* - prince's pine
10. *Pyrola secunda* - wintergreen
11. *Epilobium angustifolium* - fireweed
12. Gramineae group - grasses
13. *Spirea lucida* - spirea
14. *Hieracium* sp. - hawkweed
15. *Rosa* spp.
16. *Vaccinium membranaceum* - black huckleberry
17. *Rubus parviflorus* - thimbleberry
18. *Populus tremuloides*

3. Mixed Type: Only three samples were taken in the mixed type. It is very difficult to describe for the plant species are so mixed and variable.

The soil is quite dry in the mixed type.

On the few samples studied, the site index was high -- 150 and 190 based on Douglas fir.

Conifers in the mixed type represent advance regeneration which will soon produce seed. Thus conifer cover will soon dominate these areas. In 1956, 20 to 25 year old fir and pine were producing good seed crops.

The major tree species found in the samples are lodgepole pine, willow and aspen. *Pachystima myrsinitos*, *Linnaea borealis*, and *Vaccinium membranaceum* are predominate in the understory.

The average height of the canopy is 25 feet.

Mixed Type List (Complete species list in Appendix I c.)

1. *Pinus contorta*
2. *Salix* spp.
3. *Pachystima myrsinitos*
4. *Populus tremuloides*
5. *Linnaea borealis*
6. *Vaccinium membranaceum*
7. *Pseudotsuga taxifolia*
8. *Betula papyrifera*
9. *Cornus canadensis*
10. *Picea engelmannii*
11. *Sorbus sitchensis* - mountain ash
12. *Shepherdia canadensis*
13. *Mahonia aquifolium*
14. *Chimaphila umbellata*
15. Gramineae group
16. *Lonicera involucrata*

4. Aspen Type: The soil under the shade of aspen is generally dry to moist. Growth is extremely good in this type as conifer growth indicated an average site index of 160 (based on Douglas fir).

The aspen type has an average height canopy of 36 feet.

The aspen type may almost be considered as a *Populus tremuloides* - *Shepherdia canadensis* - *Pachystima myrsinitos* association. *Aralia nudicaulis* and *Ailium parviflorum* (tiger lily) are also characteristic of this type.

The areas covered by the aspen type in the south end of the park makes up much of the late winter moose range. Aspen is rapidly shading out the lower willow and other available browse in the understory. Consideration should be given to methods of opening up these stands and producing more browse.

Aspen Type List (Complete species list in Appendix I d.)

1. *Populus tremuloides*
2. *Salix* spp.
3. *Shepherdia canadensis*
4. *Betula papyrifera*
5. *Pachystima myrsinitos*
6. *Pinus contorta*
7. *Cornus canadensis*
8. *Aralia nudicaulis*

9. *Linnaea borealis*
10. *Spirea lucida*
11. *Epilobium angustifolium*
12. *Populus trichocarpa*
13. *Pseudotsuga taxifolia*
14. *Mahonia aquifolium*
15. *Aster* sp.
16. *Hieracium* sp.
17. *Alnus sinuata*
18. *Picea engelmannii*
19. *Vaccinium membranaceum*
20. *Acer glabrum*

The foliose lichens with *Gladonia*, and *Polytricum* mosses, for the moss and lichen layer in most cases.

5. Willow Type: Studies of the willow type were made in 21 locations.

In the majority of willow sites, the surface soil is dry and sandy. However, most willow types occur where there is high available root moisture. This is due to naturally high water tables or seepage layers. Most of the extensive willow burns are on areas cut by wet gullies and meadows. Where surface moisture is high on willow covered burns, alder dominates, as in the wet gullies, and the willow, if present, is tall and of at least different form if not of different species.

The average site index of the willow type is 120. This is lower than in the aspen type which is 160.

Willow burns, in general, are at higher elevations than aspen-covered areas. The common pattern, if going from the valley up a mountain, is to go from aspen through willow and thence into open sub-alpine burn.

The question of why willow dominated some areas while aspen came back thickest on others is confusing but interesting. It would not appear to be due to available seed source, as with conifers. A study of recent burns seems to indicate that willow regenerates mainly from roots not killed by fire. However, this would require that willow be present in the present willow types before the fire. Therefore it follows that when assessing willow site, we should look for site differences that would not be drastically changed by fire.

Differences in elevation probably affects the site. However, the salient feature that separates the willow and aspen site is the fact that willow appears to dominate areas with a high available root moisture content well below the surface of the soil, which aspen does better in the uniformly moist soils.

Many of the better willow browse areas are the result of re-burns after the main burn of 1926. For example, much of the Stillwater area appears to have been re-burned. The willow covered part of the Archer Creek burn was about ten years old at the time of this study.

It appears that dry ground *Salix* spp. have a short life span. The age of individual willow stems was found to be 20 years old or less. However, a willow bush, when normally browsed, may persist for many years with old stems dying out and new suckers taking over as leaders.

The average height of the canopy in the willow type is 12 feet.

Like the aspen type, the willow type commonly has *Shepherdia canadensis* and *Pachystima myrsinitos*, but willow cover has *Epilobium angustifolium* and *Cornus canadensis* in greater abundance in its understory than has the aspen cover.

Willow Type List (Complete species list in Appendix I e.)

1. *Salix* spp.
2. *Shepherdia canadensis*
3. *Pachystima myrsinitos*
4. *Epilobium angustifolium*
5. *Populus tremuloides*
6. *Cornus canadensis*
7. *Aster* sp.
8. *Hieracium* sp. - hawkweed - yellow-flowered
9. *Vaccinium membranaceum*
10. *Anaphalis margaritacea* - pearly everlasting
11. *Pseudotsuga taxifolia*
12. *Pinus contorta*
13. Gramineae group
14. *Antennaria* spp.
15. *Populus trichocarpa*
16. *Pyrola* spp.
17. *Catilleja* spp. - Indian paint brush
18. *Alnus (sinuata)*
19. *Rubus parviflorus*
20. *Betula papyrifera*
21. *Mahonia aquifolium*
22. *Aralia nudicaulis* - sarsaparilla

Polytricum moss and species of foliage lichen make up most of the common moss and lichen growth.

6. Alder Type: The alder are a difficult group to summarize. There appear to be two types of alder cover in the park. The first type, growing commonly in wet swales is believed to be *Alnus tenuifolia*. The second type, growing on damp mountain slopes, is believed to be large *Alnus sinuata*. (They shall be referred to by these names hereafter.) A certain amount of distinction should be made between these two types.

The *A. tenuifolia* has an average canopy height of 24 feet, while the average height of canopy of *A. sinuata* is 13 feet. Unlike the former species, *A. sinuata* is often found mixed with willow. Of the conifers, *Picea engelmannii* is frequent in both alder types, but *Pinus contorta* is found only in the drier *A. sinuata* type.

The understory growing in alder stands has great variety. The most common plants are *Lonicera involucrata* and *Linnaea borealis*. Although no herbaceous plants dominate both alder types, there are more of the succulent than shrubby species represented.

The understory of the two type of alder should be dealt with separately. *A. sinuata* is quite similar to the willow or aspen cover types, with *Pachystima myrsinitos*, *Cornus canadensis*, and *Epilobium angustifolium* occurring commonly on this type. The *A. tenuifolia*, however, has little or no

Pachystima myrsinitos represented, but the succulent Galium boreale is found in three out of four samples.

Of the mosses, Polytricum spp. are found almost exclusively on the dryer alder type. A good representation of _____ spp. plus other mosses, and the ferns Athyrium filix - femina and Dryopteris spp. are found in the wet alder site. Equisetum spp. are noted to occur only in the samples taken in the A tenuifolia type, the conifer type, and the meadow type.

Alder Type List (Complete species list in Appendix I f.)

1. Alnus tenuifolia
2. Alnus sinuata
3. Salix spp.
4. Lonicera involucrata - purple twinberry
5. Linnaea borealis
6. Picea engelmanni
7. Cornus stolonifera
8. Pachystima myrsinitos
9. Cornus canadensis
10. Epilobium angustifolium
11. Galium boreale
12. Gramineae group
13. Ribes spp.
14. Rosa spp.
15. Rubus spp.
16. Pyrola spp.
17. Rubus parviflorus

Polytricum and _____ moss, Athyrium filix - femina, and Dryopteris Linnaeana, as well as Equisetum spp. are quite common.

7. Brush Type: The brush type includes the most arid site described in this classification. It includes the shrub-like growth covering the south facing sides of hills, rock slides, or sandy knolls.

The brush cover type has a low site quality. It has an average canopy height of only two feet.

Although this classification covered different _____, it is very probable that, if any brush type were visited, some if not all of the following shrubs would be present: Ceanothus sanguineis, Amelanchier spp., and Symphoricarpus albus. The type of cover is largely shrubby with few herbaceous plants. This is the most likely cover type in which to find: Penstemon sp., Ceanothus volutinus, Prunus virginiana demissa, and Heuchora ovalifolia.

Brush Type List (Complete species list in Appendix I g.)

1. Ceanothus sanguineis
2. Gramineae group
3. Amelanchier spp.
4. Symphoricarpus albus
5. Spirea lucida
6. Penstemon sp.
7. Ceanothus volutinus

8. Rosa spp.
9. Mahonia aquifolium
10. Apocynum _____ - spreading dogbane
11. Aster sp.
12. Populus tremuloides
13. Prunus virginiana demissa
14. Pachystima myrsinitos
15. Hubus spp.
16. Epilobium angustifolium
17. Sonchus spp.
18. Viola spp.
19. Fragaria spp.
20. Antennaria spp.
21. Heuchora ovalifolia

8. Meadow Type: Sphagnum bogs, sedge-grass meadows, and big-birch flats are included in the meadow type. These are very wet areas with a unique plant composition. Only plants that can undergo months of spring flooding can exist in this type.

The plants, with an average height of canopy of three feet, are dominated by the Cyperaceae group and Betula glandulosa. Sphagnum spp. dominate the moss layer. In the few samples that were taken, the meadow type seems to have very little variation in composition.

Meadow Type List (Complete species list in Appendix I h.)

1. Cyperaceae group
2. Betula glandulosa
3. Salix spp.
4. Pinus contorta
5. Ledum greenlandicum - Labrador tea
6. Penyanthes trifoliata
7. Gramineae troupe
8. Picea engelmanni
9. Kalmia polifolia
10. Andromeda polifolia
11. Chiogenes hispidula
12. Vaccinium oxycoccus var. intermedium - cranberry
13. Habenaria (leucostachys)
14. Spiranthea romansoffiana - ladies tresses
15. Eriophorum chamissonis - cotton grass
16. Rutus spp.
17. Potentilla palustris - marsh cinquefoil

Sphagnum predominates the moss layer but _____ is also found in the meadow type.

B. MAJOR PLANTS FOUND IN THE LOW ELEVATIONS

The plant check list, Appendix III, includes all plants encountered during this study plus other known species.

The plants in the check list, with values designated, are species which occurred in the burn or surrounding coniferous stands (Appendix III). The values are sums of the abundance - vigor

values from individual types. The burn types, especially willow, dominate the trend of these results.

The *Salix* group is the most abundant representative found at low elevations. *Populus tremuloides* is the most common deciduous tree, and *Pseudotsuga taxifolia* is the most common conifer. The most abundant low shrub species is *Pachystima myrsinitos*, while *Epilobium angustifolium* is the most widespread herbaceous plant.

The Major Plants of the Low Elevations (in order of abundance):

1. *Salix* spp.
2. *Pachystima myrsinitos*
3. *Shepherdia canadensis*
4. *Populus tremuloides*
5. *Pseudotsuga taxifolia*
6. *Cornue canadensis*
7. *Pinus contorta*
8. *Linnaea borealis*
9. *Epilobium angustifolium*
10. *Picea engelmanni*
11. Gramineae group
12. *Betula papyrifera*
13. *Vaccinium membranaceum*
14. *Rubus* spp.
15. *Alnus sinuata*
16. *Hieracium* sp.
17. *Spirea lucida*
18. *Aralia nudicaulis*
19. *Aster* sp.
20. *Rubus parviflorus*
21. *Thuja plicata*
22. *Populus trichocarpa*
23. *Rosa* spp. (nutkana)
24. *Mahonia aquifolium*
25. *Pyrola secunda*

C. AGE STUDIES

Age studies of the growth on the burns revealed that the deciduous trees come in slightly before conifers.

The average age of the conifers in the burn is 25 years. As would be expected, it took about five years for the first conifers to become established.

D. TREE SPECIES PREVIOUS TO FIRE

The study of the snags to determine the make up of the previous forest should have been more thorough. Cedar and fir snags were easy to recognize, while other species were most often missed.

Cedar predominated in areas where alder now occurs. Pine was not a common species before the burn. Hemlock much have been present in great numbers before the fire, but few snags were so identified. Decay may remove evidence of hemlock more rapidly than evidence of other

species. Douglas fir appeared to be widespread before the burn, and grew to diameters of three to four feet. It was especially common on the dry ridges now covered with willow.

PART II

A. SUB-ALPINE VEGETATION STUDY

Six areas were studied in the sub-alpine of Battle Mountain. The samples all lay between the elevations of 4500 and 6000 feet. In this very limited number of samples, five distinct cover types were analyzed. The major species of the sub-alpine were recorded.

The plant lists in this work are in order of descending abundance. However, the frequency of occurrence would have to be checked further to determine accurately the most common species of each type. It is for this reason that the complete plant list is given with each type, rather than only the most abundant species as in the low elevation descriptions.

The five types described were: (1) The climax forest of the sub-alpine. (2) The burned areas where only scattered conifers remain. (3) The arid meadow type such as borders Fight Lake. (4) The damp meadow slopes covered with profuse succulent growth. (5) The heath covered ridges.

The field notes are made from August 10 to August 17; therefore, some early-blooming plants may have been missed. However, the author spent some time in June, checking the leaves and flowers of early-blooming anemones, marigolds, etc., so that leaves only could be easily recognized later in the year.

B. SUB-ALPINE COVER TYPES

1. Sub-alpine Climax Forest: The distribution of the alpine fir - Engelmann spruce forest varies considerably with aspect. These trees grow at higher elevations on north slopes than on south slopes and many have different flora in the understory depending on aspect. It is the most common forest type found between elevations of 3500 and 6000 feet.

Two samples were taken in the climax forest type, each at an elevation of about 5,500 feet. The samples were taken on almost level terrain. The influence of meadows is undoubtedly felt in the areas studied; therefore, this floristic description is not typical of the very dense sub-alpine forest.

Soils in the study areas were typical sub-alpine podsoles. Alpine fir and Engelmann spruce are the major tree species with alpine fir being the dominant species. Alpine fir usually reaches a dbh of 15 to 20 inches, and a corresponding height of about seventy-five feet at an age of 200 years. Engelmann spruce grows to the following dimensions (one large typical tree measured): dbh: 31.2 inches; height: about one hundred feet; age: 310 years. Spruce seems to have a slightly longer life span.

Alpine fir seedlings are coming in on the edges of many of the meadows. This advance is difficult to explain. There may be either a meadow - conifer rotation in the sub-alpine, or the natural timberline may be advancing to higher elevations with a continental climatic change. It should be noted also that these advance seedlings, as they become dense, are probably very susceptible to the Brown Felt Blight, *Herpotherichia* sp., which is common in the sub-alpine.

The alpine fir - Engelmann spruce forest is a climax type. In this forest, an equilibrium has been reached between the forest trees and the plants of the understory. These understory inhabitants are few in number and less variable than plants in burn types. The type of forest studied might well be called an: *Abies lasiocarpa* - *Valeriana sitchensis* - *Ritalla breweri* - *Tiarella unifoliata* - *Vaccinium* association.

Sub-alpine Climax Forest Type List

Abies lasiocarpa
Valeriana sitchensis
Mitella breweri
Arnica latifolia
Vaccinium membranaceum
Tiarella unifoliata
Gramineae group
Picea engelmanni
Hieracium sp.
Epilobium sp.
Veratrum viride - false hellebore
Saxifrage sp.
Pedicularis bracteosa

The mosses are predominately: _____ and Dicranum spp.

2. Sub-alpine Burn Type: Burns have left large areas of the park's sub-alpine country covered with dry snags. These remnants of the previous forest remain hard for many years, probably due largely to the cool temperatures which inhibit the action of decaying fungus.

Regeneration is slow and spotty. This is due to a poor seed source, poor growing site, and the heavy competition from dense thickets of false azalea and white rhododendron. The alpine burn type, therefore, forms quite a stable niche for wildlife.

The sample take in the burn was on a west facing slope at about 4,700 feet elevation. A conifer kill of about seventy percent resulted from the fire; therefore, a fairly good seed source was available and alpine fir was a dominant species.

Sub-alpine Burn Type List

Abies lasiocarpa
Rhododendron albiflorum
Valeriana sitchensis
Disporum oregonum
_____ ferruginea
Arnica latifolia
Rubus pedatus
Vaccinium membranaceum
Lupinus spp.
Epilobium angustifolium
Picea engelmanni
Sorbus sitchensis
Veratrum viride
Clintonia unifoliata
Hieracium sp.
Pyrola secunda
Gramineae group

Erigeron salsuginesis
Viola Soo.
Tiarella unifoliata
Mitella breweri

3. The Arid Sub-alpine Meadow Type: Some of the low, rather level, meadows have a very thin humus layer over a rocky or clay soil. These areas dry out in the hot summer months. The cover seldom exceeds six inches in height and appears as if it were being produced on an arid plain.

One sample was taken near Fight Lake at about 5,500 feet elevation. This type is the least typical of any of the sub-alpine floristic descriptions. However, grasses are abundant in any of these areas with variation occurring in the lesser plants.

Arid Meadow Type List

Gramineae group (Phleum alpinum)
Sibaldia procumbens
Cyperaceae groups
Erigeron sp.
Senecio triangularis
Vaccinium caespitosum
Gentiana (calycosa)
Potentilla diversiloba
Epilobium sp.
Antonnaria spp.
Caltha leptosepala
Erigeron salsuginesis
Castilleja spp.

Polytricum is the most common moss type, with local concentrations of sphagnum also being found.

4. Moist Sub-alpine Slope Type: Dense flowering herbs one to two feet tall on moist slopes are the most attractive features of the sub-alpine. The peak of the blossoming period is from early to mid August.

The soil here is deep and black, with a high moisture content supplied by a seepage action. One area was studied in this type at about 5,500 feet elevation on a south facing slope.

Moist Slope Type List

Senecio triangularis
Erigeron salsuginesis
Valeriana sitchensis
Castilleja spp.
Arnica latifolia
Lupinus spp.
Veratnum viride
Anemone occidentalis
Letarrhena amplexifolia

Mimulus lewisii
Clatonia lanceolata
Trollius laxus
Pedicularis bracteosa
Artemisia longepedunculata
Gramineae group (Phleum alpinum)
Cyperaceae group

5. Dry Heath Ridge Type: On dry ridges and open knolls, herbs give way to the more hardy shrubs. The heath growing between the clumps of alpine fir make up the transition type known as timber line: the border between the highest trees and the rocky slopes above.

Dry Health Ridge Type List

Phyllodoce empetrifomis
Cassiope mertensiana
Spirea pectinata
Antennaria spp.
Vaccinium caespitosum
Gramineae group
Gentiana (clycosa)
Erigeron salsuginesis
Arnica latifolia
Pedicularis bracteosa
Anemone occidentalis
Sibaldia procumbeus
Lycopodium (annotonium) and Cladonia lichens were also found/
Yellow heather (Phyllodoce glanduliflora) was not found in this type but was observed on the higher alpine slope.

III. DISCUSSION

Edwards (1954) described the extent of the destruction of the 1926 fire which denuded a large part of the south end of Wells Gray Park: "In all, 60 percent of the vegetation below 4,000 feet has been reduced from climax forest to an early seral state. Fire has drastically changed the vegetation of the valley. Catastrophic change in the ecology of the area is an inevitable result."

Continuing, Edwards described the comeback of the flora: "Fireweed and willow began to heal the land in an environment suddenly suitable for them".

Fireweed and willow are two of the first inhabitants of recent burns. However, for the first few years after a burn, almost any seed that finds its way onto the area will become established. This results in regeneration of a variety of plants in a fire sere flora with little regulation as to site. The confusing admixture of plants that is present in the park burn is typical of burn flora. Climax forests on the other hand are rather well defined plant associations. The wide variety of plants found on the present burn will be modified slowly to form sub-climax and climax types. The immature sub-climax type found in the study are difficult to differentiate and are undergoing rapid change in composition. Individual types analyzed in this report should progress to individual sub-climax and climax types. It should be possible to follow these successions from immature to climax. If such succession can be recognized, then management priority should be given to areas, both sub-climax and climax, which produce the best browse plants at immature stages of development.

The conifer climax forests are important to the park for their timber value. However, priority must be given to the types that produce the best winter range at some stage in their development.

The essence of multiple use is to manage individual areas for maximum benefits. If priority is to be given to moose range, then management should follow this pattern”

1. At an expense to timber value, the sub-climax types of best winter moose range should be held at this stage of development for some time.
2. Climax types producing the best winter range when burned should be the first to be logged and burned to produce more winter range.

Willow, so important as moose browse, predominates where there appears to be very dry surface conditions, but an effective water table quite close to the soil surface. However, willow and its low growing relatives such as red osier, mountain ash, etc., are being rapidly crowded out in areas which they do not dominate.

The advance of coniferous regeneration was, at the date of this study, spreading its seed farther towards the center of the burned areas. It is putting on maximum height growth now, and is effectively crowding out deciduous species. Douglas fir is the commonest species. Where sufficient seed is available, regeneration is dense.

IV. RECOMMENDATIONS

- (1) Any active land management plan should include steps to get more willow growing at low elevations in the park. This may include the controlled use of fire.
- (2) Where Douglas fir is dense, pruning and thinning should be carried out now, if a multiple use plan is to be later effected in the park.

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