

FIELD MANUAL SPECIES LIST

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R.C.W.

NOTE:

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MANUAL OF FIELD INSTRUCTIONS

FOR

VEGETATION TYPE MAP OF CALIFORNIA

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## PRELIMINARY OUTLINE FOR FIELD MANUAL

## CALIFORNIA VEGETATION TYPE SURVEY

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# FIELD MANUAL - CALIFORNIA VEGETATION TYPE SURVEY

## I. INTRODUCTORY

### 1.-FOREWORD

This project consists of a survey of natural vegetation, exclusive of desert areas and the larger valleys which are mainly devoted to agriculture. The region to be covered includes the State of California and those parts of Region 5 National Forests and adjacent areas that extend into the neighboring States of Nevada and Oregon; an area of approximately 70 million acres.

Beginning in 1926, two years prior to the authorization of the Forest Survey under the McSweeney-McNary Research Act, the project is now a part of that nationwide survey of forest resources. From an initial purpose of merely providing data for statewide land-use and fire-protection policies, it has evolved into the present detailed survey which is outlined on the following pages.

This field manual applies to but one phase of the Forest Survey project in the California Region--the Vegetation Type Map, and covers all data collected simultaneously with its preparation. At appropriate times additional work plans will be prepared covering the other phases of the Forest Survey. The sum total of all the phases will aim towards providing, (1) the information required under the broad objectives of the Forest Survey as defined in the act authorizing it, and (2) the basic information discussed below.

### 2.-PURPOSE OF THE VEGETATION TYPE SURVEY

This survey is designed to collect information basic in character for many purposes, so that it will be of value, not only for obvious needs of the present, but also for perhaps unforeseen developments of the future. Among the present obvious needs may be listed the following:

(1) Basis for land use studies and policies, i.e. wood production, recreation, watershed, grazing, wildlife management, etc.

(2) Basis for rating fire hazard.

(3) Basis for research and its application in fire, forest management, erosion and water conservation, wildlife management, grazing, etc.

(4) Basis for ecological studies involving correlation of the distribution of vegetation with climate, soil and other factors.

(5) The data for forested areas will be of value in facilitating the timber volume inventory, the next step in the Forest Survey.

### 3.-BASE MAPS

The 15 or 30 minute topographic quadrangles of the U. S. Geological Survey are used both as base maps and as control for the field survey. Bromide enlargements of the 30 minute quadrangles to the same scale as the 15 minute quadrangles are made so that base maps on a uniform scale of approximately 1 inch equals 1 mile are available for all field work. All maps are cut to fit the letter-size tatum holders and mounted on cloth to facilitate handling and to prevent excessive wear. The Vegetation types are mapped on these sheets by direct sketching from ridges, peaks, and other vantage points, supplemented by frequent sample plot checks.

### 4.-KINDS OF DATA COLLECTED

#### (a) Vegetation Type Map

A vegetation type map showing broad plant associations divided, exclusive of herbaceous formations, into pure and mixed stands in which the dominant 1/ species are indicated by symbols. In herbaceous formations subtypes are not usually delineated because in most cases their boundaries

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1/ The term "dominant", when applied in this Manual to the composition of vegetation types, refers to any species that occupies 20 percent or more of the formed by the particular class of vegetation, or formation (see Table 1), to which the species belongs.

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cannot be distinguished in mapping. However, at each sample plot location, the species found in greatest abundance there are designated on the map.

(b) Supplementary Map

A supplementary map showing, together with other data:

- (1) Occurrence by species, of individuals and small groups of trees in otherwise treeless types.
- (2) Occurrence by species, of scattered individuals or groups of ecologically important trees not abundant enough to be shown as dominants on the type map.
- (3) Occurrence of shrub species of especial importance, the range of which would not be indicated by either the type map or sample plots.
- (4) Occurrence of mountain meadows that are too small to be shown on the type map.
- (5) Boundaries of comparatively recent burned-over areas that are visible on the ground.

(c) Forest Resource Map

A map for each quadrangle unit which includes areas considered capable of growing commercial stands of timber except where this use is precluded by a higher use, such as recreation. It is compiled from the vegetation type map and the timber data that are collected simultaneously with the mapping of the vegetation. These timber data, recorded on overlay sheets, consist of the following:

- (1) A classification of all land into old growth, or virgin, timber; young growth timber, even-aged and uneven-aged stands; deforested areas; and nonforested areas.

- (2) A classification of all timber and potential timber land according to its productivity for growing commercial tree crops, or in other words, a site index classification. (The site index, or measure of productivity, that is used here is based upon the height attained by the average dominant  $\frac{2}{3}$  tree (in 300 years.)

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$\frac{2}{3}$  When applied to site index, the term "dominant" refers to the crown class to which the tree belongs. See "A Tree Classification for the Selection Forest of the Sierra Nevada" by Duncan Dunning, etc.

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- (3) A division of the even-aged, young growth stands into 20 year age classes, further subdivided into well, medium, and poorly stocked areas.

(d) Sample Plots

Sample plots, referenced to the map, and of the various vegetation type and subtypes. These show, among other things, species composition, size and stand density of trees and shrubs, and depth of litter.

(e) Herbarium

An herbarium for each quadrangle unit, containing as a minimum specimens of all species shown on the map or sample plots.

(f) Photographs

Photographs representative of all types encountered together with other interesting vegetation conditions, referenced to the map so that they may be repeated at a later time for the purpose of recording vegetational changes.

## II. THE VEGETATION TYPE MAP

### 1. THE PUBLISHED MAPS

The statewide vegetation map, when completed and published, will ~~com-~~<sup>prise</sup> ~~prise~~ a total of approximately 230 map units. As previously stated, they will embrace all lands exclusive of the deserts and the larger valleys which are mainly devoted to agriculture. These map units will consist of the standard U. S. Geological Survey 15 and 30 minutes topographic quadrangles upon which the vegetation types will be shown by an overprint of color and the dominant species by symbols. Wide map margins will provide necessary space for the customary legend, a profile helpful in visualizing the relationships of types with topography and elevation, a table summarizing type areas by such units as counties and national forests, and textual material explaining the basis for the type classification and describing the various types shown on the quadrangle.

### 2. BASIS FOR TYPE CLASSIFICATION

#### (a) Basis for Classification of Vegetation in General

In view of the complex vegetation conditions to be found in California, resulting from wide variations in climate and disturbances by human activities, it was necessary to develop a flexible scheme of type classification. It was also necessary, in order that this scheme be adapted to the direct-sketching method of mapping, that it be a classification of the vegetation that is visible externally as from an airplane.

Two concepts, (1) pure and mixed stand subtypes and (2) mosaics, lend the essential flexibility. The first concept attempts to depict as accurately as possible natural plant associations, and the second, the complex vegetation conditions to be found either naturally or as a result of fire or other disturbances. A consideration of Table 1 will explain the application of these concepts to vegetation in general.

Table 1. BASIS FOR CLASSIFICATION OF VEGETATION IN GENERAL

| (1)       | (2)                     | (3)                      | (4)                              |
|-----------|-------------------------|--------------------------|----------------------------------|
| HERBS     | SHRUBS                  | TREES                    | MOSAICS (or Composites of 1,2,3) |
| MARSHLAND | SAGEBRUSH               | BROADLEAF<br>(Hardwoods) | SHRUB-HERB<br>TREE-HERB          |
| MEADOW    | CHAPARRAL-<br>SAGEBRUSH | CONIFER<br>(Softwoods)   | TREE-SHRUB<br>TREE-SHRUB-HERB    |
| GRASSLAND |                         | CONIFER-<br>BROADLEAF    |                                  |

In this scheme the vegetation is divided into four formations or classes: (1) HERBS, (2) SHRUBS, (3) TREES, and (4) MOSAICS. In all cases understory vegetation is not considered, but only those elements of the vegetation cover that are visible from above.

HERBS include all MARSHLAND, MEADOW and GRASSLAND where the herbaceous vegetation forms more than 80 percent of the cover. \*

SHRUBS include:

- (1) SAGEBRUSH, where more than 80 percent of the cover is formed by the woody species of Salvia, Artemisia, Eriogonum and other plants of like character.

\*

(2) CHAPARRAL, where more than 80 percent of the cover consists of shrubs not sagebrush-like in their characteristics, as for example, shrubby Quercus species, Arctostaphylos and Ceanothus.

(3) CHAPARRAL-SAGEBRUSH, where both CHAPARRAL and SAGEBRUSH species occur, but with neither forming more than 80 percent of the cover.

**TREES include:**

(1) BROADLEAF, where more than 80 percent of the cover consists of broadleaved trees.

(2) CONIFER, where more than 80 percent of the cover consists of coniferous trees.

(3) CONIFER-BROADLEAF, where both coniferous and broadleaved trees occur, but with neither forming more than 80 percent of the cover.

MOSAICS include areas where the vegetation is not purely herbaceous, shrubby, or arborescent but a composite of two or more of these formations, no one of which forms more than 80 percent of the cover.

An amplification of this general classification of vegetation, which is simply a division into pure and mixed formations, by a further and similar segregation into pure and mixed stands by species (subtypes), completes the basic scheme of the classification. A pure stand is defined as one in which a single species forms more than 80 percent of the cover and is designated by the single dominant. A mixed stand is one that is composed of two or more species, no one of which occurs in excess of 80 percent and it is ordinarily designated by those dominants individually forming 20 percent or more of the cover. In the MOSAICS, however, this percentage is applied to each class of vegetation (HERBS, SHRUBS, TREES) separately.

For example, in a TREE-SHRUB MOSAIC both the TREE and SHRUB species forming 20 percent or more of the aggregate area occupied respectively by TREES and SHRUBS are designated. In SHRUB formations the percent of cover formed by the various species is estimated directly on an area basis but in TREE formations it is frequently easier to approximate this by tree counts. These percentages serve more accurately as guides for the types discussed in the following pages, and for pure subtypes which stand out in fairly bold relief than for mixed stand subtypes. Where the latter merge from one subtype to another so gradually that there are no visible dividing lines, the sample plots serve as a basis for a deliniation which gives at least close altitudinal and slope-exposure relationships.

(b) Classification for the California Vegetation

It will be noted that the scheme discussed in the preceding paragraphs does not set up any definite list of vegetation types for California but merely provides principles which enable the mapper to recognize and to portray graphically the various pure and mixed stand subtypes found on the ground. What all of the specific vegetation types will be, can be finally stated only upon completion of the survey itself. However, the survey has now progressed far enough to make it possible to show in Table 2 the manner in which these principles may be applied to the California vegetation.

Table 2. VEGETATION TYPES OF CALIFORNIA

| HERRACEOUS<br>TYPES   | SHRUB<br>TYPES  | WOODLAND<br>TREE TYPES  | COMMERCIAL<br>TREE TYPES  | SUBALPINE<br>TREE TYPES  |
|---|---|---|---|--|
| MARSHLAND<br>(MEADOW or<br>GRASSLAND)   | SAGEBRUSH<br>CHAMISE<br>CHAPARRAL<br>SEMIDESERT<br>CHAPARRAL<br>TIMBERLAND<br>CHAPARRAL | WOODLAND<br>PINON<br>JUNIFER<br>MISCELLANEOUS<br>CONIFERS           | REDWOOD BELT<br>DOUGLAS FIR<br>BELT<br>SPRUCE BELT<br>PINE BELT<br>PINE-FIR BELT<br>FIR BELT  | LODGEPOLK-<br>WHITE PINE<br>BELT<br>WHITEBARK-<br>FOXTAIL PINE<br>BELT |
| (HERB-SHRUB<br>MOSAIC shown<br>as subtype<br>of nearest<br>related<br>HERRACEOUS<br>TYPE) | (SHRUB-HERB<br>MOSAIC shown<br>as subtype<br>of nearest<br>related<br>SHRUB TYPE)       | WOODLAND-GRASS,<br>WOODLAND-<br>SAGEBRUSH<br>WOODLAND-<br>CHAPARRAL | (CONIFER-HERB and CONIFER-SHRUB MOSAICS<br>shown as subtypes of nearest related<br>CONIFEROUS TREE type. CONIFER-BROADLEAF<br>TREE associations treated as MOSAICS and<br>shown in same GROUP.) |  |

<sup>2/</sup>Areas within any type with approximately 50 percent or less vegetation cover are designated SEMIDESERT.

This table segregates the natural vegetation of California into 21 types. Not listed in the table, but included in the classification are three additional types: BARREN and DESERT, CULTIVATED and URBAN, and FOREST PLANTATIONS. All of the types are differentiated on the map in color legend. Each represents an attempt to group together related subtypes with generally similar fire hazard characteristics, and/or uses or qualities of economic importance. Thus the broad color divisions serve to make the maps more readily usable by forest rangers, supervisors, engineers, and others charged with the management of wild lands, while the more detailed subtype delineation provides the basic information on vegetation desired by the research workers in forestry, ecology, and allied sciences.

Under the heading "SHRUB TYPES" it will be noted that the chaparral or brushfield belt is divided into four types. This division is made largely on the basis of fire hazard characteristics. The first, CHAMISE CHAPARRAL, is distinguished by the dominance of Adenostoma fasciculatum. This shrub has fine needle-like leaves which do not build up any appreciable ground litter and a thin, or diffusely branched, crown canopy; characters that tend to make fires easier to control. In the second type, or the CHAPARRAL proper, Adenostoma fasciculatum is nearly or entirely absent. In contrast with the CHAMISE CHAPARRAL this type normally produces a deep litter is of almost impenetrable density, and attains a greater height. Consequently it creates a high fire hazard. The third chaparral type is designated SEMIDESERT CHAPARRAL because it normally clothes the mountain slopes bordering the desert. In species composition it is closely related to the CHAPARRAL type proper of adjacent areas but differs from it in being characteristically open instead of forming a dense uninterrupted cover. For this reason it presents a low degree of fire hazard. These three chaparral types are characteristic of the Upper Sonoran Life Zone, 4/ while the fourth, TIMBERLAND CHAPARRAL, is characteristic of either the Transition or Canadian Life Zones.

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4/ Hall, H. M. and J. Grinnell, "Life Zone Indicators in California", Proc. Calif. Acad. Sci. 4th series, vol. 9, No. 2, pp. 37-67. 1919.

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It has been called TIMBERLAND CHAPARRAL because it is frequently a temporary type replacing fire-destroyed coniferous timber stands. In fire hazard characteristics, it is similar to the CHAPARRAL type.

The WOODLAND TREE TYPES are characterized by either BROADLEAF or CONIFEROUS TREE species whose wood is used for little else than fuel. a division is made into six types, as follows:

(1) The WOODLAND type proper is primarily a BROADLEAF association which usually forms a closed canopy. (2) PINON-JUNIPER comprises stands characterized by the dominance of either pinon or juniper, or both. This type is usually associated with climatic conditions that approach those of the desert regions. (3) MISCELLANEOUS CONIFERS embrace stands of such trees as Monterey pine, Coulter pine, Knobcone pine, bigcone spruce, McNab cypress, and bristlecone fir, most of which are endemic to California and restricted in distribution. (4) WOODLAND-GRASS, (5) WOODLAND-SAGEBRUSH, and (6) WOODLAND-CHAPARRAL are MOSAIC types consisting respectively of GRASSLAND, SAGEBRUSH, and CHAPARRAL areas, with more or less scattered individuals and small clumps of BROADLEAF trees with which the Digger pine may be associated. The WOODLAND-GRASS type is primarily of grazing use and is one of the principal formations in the foothills of the Sierra Nevada and Coast Range Mountains. The WOODLAND -SAGEBRUSH and WOODLAND-CHAPARRAL in many cases apparently represent a deterioration of the WOODLAND-GRASS type resulting from fires or overgrazing.

The COMMERCIAL TREE TYPES are designated because they are characterized by those CONIFERS that are at present considered of possible commercial value in California for such products as lumber and pulp. This grouping is based entirely on species, however, so that it also includes areas on which these values are precluded by such local conditions as higher values, soil, climate, and topography.

~~as higher values, soil, climate, and topography.~~

These types are mainly characteristic of the Transition and Canadian Life Zones. Upon the basis of use and fire hazard characteristics a division into six belts is made as follows: (1) REDWOOD, (2) DOUGLAS FIR, (3) SPRUCE, (4) FINE, (5) PINE-FIR, and (6) FIR.

The SUBALPINE TREE TYPES include those CONIFERS which, as the name implies, are situated at the higher altitudes. They embrace areas often possessing high scenic and recreational value but slight, if any, value for commercial growth of saw-timber or pulpwood. In these types growth is usually slow because of severe climatic conditions and the trees are frequently scattered in occurrence, distorted in form, and relatively low in height. Two broad belts are recognized. The first, the LODGEPOLE-WHITE PINE BELT, occurs in both the Canadian and Hudsonian Life Zones, while the second, the WHITEBARK-FOXTAIL PINE BELT, is restricted to the Hudsonian Life Zone.

Following the designation "MOSAICS" it should be noted that CONIFER-BROADLEAF (TREE) associations are treated here as MOSAICS even though, as shown in Table 1, they are not considered such a formation. If they were shown merely as TREE associations, only those species occurring to the extent of 30 percent or more of the total cover would determine the type and be indicated in the symbol designation.

Such stands, where the commercially valuable CONIFERS consisted of two or more species, each forming less than 20 percent of the TREES but together comprising a much larger proportion, would thus be shown as WOODLAND types and no indication made of the CONIFERS also present. Stands of this character are quite common in the lower part of the commercial timber belt in California and are of sufficient value to justify being included with the COMMERCIAL TREE TYPES. Furthermore, because the CONIFERS (except Digger pine) and the BROADLEAF trees each form such a distinctive group of their own, it has been deemed advisable to treat associations of the two groups as MOSAICS so that a record of their occurrence will not be lost. Therefore, in CONIFER-BROADLEAF associations (except where Digger pine is the only CONIFER) where the CONIFERS as a group form 20 percent or more of the TREE cover, the CONIFEROUS species occurring to the extent of 20 percent or more of that group determine the type and are listed in the symbol designation. In addition, the symbols for all BROADLEAF species occupying 20 percent or more of the BROADLEAF group are listed.

The foregoing discussion includes the types shown in Table 2 that are not in themselves self-explanatory. Definitions of all the types follow in this paragraph.

### 3.-TYPE DEFINITIONS AND LEGEND

#### (a) Application of Definitions

The definitions given on the following pages are intended to apply to the types as they are recognized in their typical condition.

They are to be adhered to only insofar as the vegetation as it is found on the ground can be readily fitted to them. The percentages given are likewise to be used as guides rather than as absolute quantities. Any condition encountered that is not specifically described here should be handled in such a manner as to present as accurate a picture of the vegetation as is possible. The usual procedure for doing this is to map the area with the color of the type it most closely resembles, and to include the symbols of all species occurring to the extent of 20 percent or more of the cover in each dominant class of vegetation. Brief written descriptions should also accompany such conditions. However, this practice should not be carried to the point that ecologically distinct types or subtypes are grouped together merely to postpone a somewhat difficult decision. For a method of checking on judgment of mosaics, see the paragraph on sampling under "Degree of Stocking" shown in connection with Field Procedure of Timber Overlays. Examples of type variations follow the definitions. It is important to remember that only the vegetation which is exposed to the sky determines the type, and that only the species of this exposed vegetation are indicated by symbol designation.

(b) Order of Symbols

As far as practicable record the species, using the appropriate symbols as listed in the Appendix, in the order of their relative abundance on the ground. Exceptions to this rule occur only in the following instances: (1) In MOSAICS involving various combinations of TREE, SHRUBS, and HERBS; give the TREE species first priority in the symbol designation, (2) In COMMERCIAL TREE types, give the COMMERCIAL TREE species priority in the symbol designation over the other TREE species.

For any continuous area of similar species composition only one order is to be given; the one which occurs over the largest part of the area.

Such areas should also be contained within one type boundary; not broken up into subtypes with the attempt to show change in order of species dominance.

(c) Type Boundaries, Symbols, and Ungrouped Types

----- Type boundaries - broken line (Higgins' waterproof black ink)

Af Symbols (Higgins' waterproof black ink) See Appendix for complete list.

Note: The number preceding each type designates the official type number. These do not appear on the map.

1.  BARREN (Dixon's #352 $\frac{1}{2}$ , or lead pencil.) Areas which are practically devoid of vegetation. These types constitute absolute fire barriers. Barrenness due to very recent clean burns is not included within this type (See Special Cases). Designate by the symbol Ba.

1.  DESERT (Dixon's #352 $\frac{1}{2}$ , or lead pencil.) Areas of the true desert of the Lower Sonoran Life Zone. Delineate distinctive subtypes characterized by the dominance of such species as Yucca arborescens, Larrea tridentata glutinosa, Prosopis spp., and Atriplex spp. Where such distinctive species are absent, merely record those found in greatest abundance on each of uniformly distributed sample plots at the location where the plot was taken. Designate areas not sampled, such as small areas or those not easily accessible, by the symbol Ds.

 SEMIBARREN Areas within any type whose vegetation, while not so scanty as to cause the area to be classified as barren covers approximately 50 percent or less of the ground surface. Exceptions are areas of "Badlands" classification.

Designate by diagonal hatching with Higgin's waterproof black ink over the color for the appropriate type.

 **HADLANDS** Areas within any type whose vegetation is scanty enough to be classed as semibarren but which is caused mainly by presently active excessive erosion. This classification is evidenced by the presence of numerous erosion gullies and usually an erosion pavement. A deposition of eroded soil and debris is often found in the valleys below the areas. Designate by diagonal hatching with Higgin's waterproof blue ink over the color for the appropriate type.

5.  **CULTIVATED** (Dixon's #322) Areas cultivated for crops at the present time, including those recently cultivated but at present lying fallow, natural haylands that are regularly cropped, and irrigated pastures.

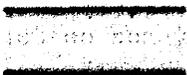
Designate by the symbol Cu.

NOTE: (k) Special Cases

5.  **URBAN** (Dixon's #322) Residential, business, and industrial areas. Deliniate, and designate by the symbol Res.

(d) Herbaceous Types

Note: MOSAICS with SHRUBS are shown as subtypes of the types they most closely resemble. MOSAICS with BROADLEAF TREES are shown as described under the specific BROADLEAF WOODLAND TREE types. MOSAICS with CONIFEROUS TREES are shown as subtypes of the appropriate CONIFEROUS TREE type.

2.  **MARSHLAND** (Dixon's #323) Tidal or inland marsh areas on which more than 80 percent of the vegetation cover consists of such HERBACEOUS species as Salicornia spp., Typha spp., or the tall Scirpus spp.

- Grass

2. MEADOW (Dixon's #353) Areas on which more than 80 percent of the vegetation cover consists of HERBACEOUS species that are characteristic of moist situations (except those classified as MARSHLAND), such as most of the rushes and sedges. This type is found principally on poorly drained flats and on very wet slopes within and above the timber belt. They need not necessarily be wet thruout the year; some may dry out during the summer season. Designate by the symbol Md , and in large MEADOWS where sample plots are taken, record the species found in greatest abundance at the locations where the plots were taken.

- Grass

2. GRASSLAND (Dixon's #353) Areas on which more than 80 percent of the vegetation cover consists of grasses and other associated HERBACEOUS species. This is a characteristic type of slopes and other dry situations, and occurs principally below the timber belt. The species found in greatest abundance on each of uniformly distributed sample plots are recorded at the location where the plot was taken. Designate areas not sampled, such as small areas or those not easily accessible, by the symbol Gr.

Note: Subtypes within the above major classes of grassland subtypes are not delinfated. These major classes of grassland subtypes, however, are deliniated, one from another.

- Grass

2. PERENNIAL HERB (Dixon's #353) Areas on which more than 80 percent of the vegetation cover consists of such conspicuous HERBACEOUS species as Hypericum perforatum, Pteris aquilina lanuginosa, Wyethia mollis, and Xerophyllum tenax. Deliniate distinctive subtypes and record the dominant species where practicable. Where the mixture is

such that dominant species cannot readily be determined, merely record the species found in greatest abundance at the locations where sample plots were taken, or, in unsampled areas, record the symbol Hb.

(e) Shrub Types

Note: MOSAICS with HERBS are shown as subtypes of the type they most closely resemble. MOSAICS with BROADLEAF TREES are shown as described under the specific BROADLEAF WOODLAND TREE types. MOSAICS with CONIFEROUS TREES are shown as subtypes of the appropriate CONIFEROUS TREE type.

✓ 4. [REDACTED] <sup>Sage</sup> SAGEBRUSH (Faber's #44) Areas on which more than 80 percent of the vegetation cover consists of the SHRUB, or woody, species of such genera as Artemisia, Salvia, Eriogonum, Baccharis, Eriodictyon, and others of like character.

5. [REDACTED] <sup>Peninsular Watershed</sup> CHAMISE CHAPARRAL (Dixon's #343) Areas on which more than 80 percent of the vegetation cover consists of SHRUB species, with Adenostoma fasciculatum forming 20 percent or more of such species.

✓ 6. [REDACTED] <sup>Peninsular Watershed</sup> CHAPARRAL (Faber's #49) Areas on which more than 80 percent of the vegetation cover consists of chaparral species, other than Adenostoma fasciculatum, of the Upper Sonoran Life Zone. (See) List of species indicators in Appendix). Exceptions are those areas more properly classified as SEMIDESERT CHAPARRAL. The type is characteristically dense, with a deep litter.

✓ 8. [REDACTED] <sup>Great Salt Lake Desert</sup> SEMIDESERT CHAPARRAL (Faber's #14) Similar in species composition to the CHAPARRAL type, but differing from it in being characteristically open, with the intervening ground space more or less lacking in vegetation growth instead of forming a dense, uninterrupted

cover. The type usually occupies slopes either bordering the desert, or within the range of the desert climatic influence. The factor, rather than lack of soil, seems to be the reason for the openness of the type. SEMIBARREN areas in the CHAPARRAL type proper, where the openness is due to steepness of slope, or lack of soil, or both, should not be included here. Such species as the Pinon pines, Juniperus californica, or Stenotaphrum linearifolium will usually be found in or adjacent to the SEMIDESERT CHAPARRAL type, and may be used as indicators.

7. [REDACTED] *Barro Colorado Island* TIMBERLAND CHAPARRAL (Dixon's #335) Areas on which more than 80 percent of the vegetation cover consists of chaparral species other than Adenostoma fasciculatum, and where the species fall into either of the following groups: (For the life zone position of the various species, refer to the list of species indicators in the Appendix.)

- (1) 20 percent or more of the chaparral cover consists of those species which are restricted to the Transition and Canadian Life Zones, or
- (2) More than 80 percent of the chaparral cover consists of those species whose life zone position is intermediate between Upper Sonoran and Transition (not including invading Upper Sonoran species.) In addition, either (a) one or more species (TREE or SHRUB) restricted to the Transition and Canadian Life Zones must occur scattered through the area and on the same site (not in pockets of better soil), or (b), other evidence, such as position and soil, must be present to indicate that the area belongs to the Transition

or Canadian Life Zone.

Note: This type should be mapped independently of the timber overlay classification discussed under the section entitled "FOREST RESOURCE MAP".

(f) Woodland Tree Types

Note: MOSAICS of BROADLEAF WOODLAND TREES with HERBS or SHRUBS are shown as described under the specific BROADLEAF WOODLAND TREE types, MOSAICS of CONIFEROUS WOODLAND TREES with HERBS or SHRUBS are shown as subtypes of the appropriate CONIFEROUS WOODLAND TREE type. Associations of BROADLEAF WOODLAND TREES with CONIFERS are treated as MOSAICS but are shown as subtypes of the proper CONIFEROUS TREE type. Associations of WOODLAND TREES with either COMMERCIAL or SUBALPINE TREES are shown as subtypes of the appropriate COMMERCIAL or SUBALPINE TREE type.

✓ [REDACTED] WOODLAND (Dixon's #349) Areas on which more than 80 percent of the vegetation cover consists of BROADLEAF TREE species above or in association with Pinus sabiniana. The stands are typically dense in character, and may or may not have a concealed understory of HERBS or SHRUBS.

This designation also embraces the WOODLAND that occurs in narrow strips along streams and ravine bottoms. These subtypes, unless of unusual width, are mapped only where they are surrounded by treeless types. In such localities they are of some importance. Where these subtypes are surrounded by other TREE types, they are so frequently obscured that they cannot be delineated consistently and therefore should be omitted. Here, they are of no great significance.

11. [REDACTED] WOODLAND--GRASS (Dixon's #324) A MOSAIC type in which the vegetation cover is made up of both WOODLAND and HERBACEOUS species, with each class of vegetation exposed to the extent of 20 percent or more. The stands are typically open in character, the HERBACEOUS vegetation being exposed to the sky rather than concealed as understory vegetation. Record the dominant WOODLAND species by the appropriate symbols. List specific HERBACEOUS species only where the more conspicuous ones occur and where the dominants are easily determined; elsewhere record the symbol Md, Gr, or Hb as the case may be. This designation also embraces the WOODLAND--GRASS that occurs in narrow strips along stream and ravine bottoms, and which is important enough to appear on MAP #1.

10. [REDACTED] WOODLAND--SAGEBRUSH (Dixon's #324) A MOSAIC type in which the cover is made up of both WOODLAND and SAGEBRUSH species, with each class of vegetation exposed to the extent of 20 percent or more. Where HERBACEOUS species also occupy 20 percent or more of the exposed cover, include the appropriate symbol for that class of vegetation. Where chaparral species occur to the extent of 20 percent or more of the shrub but less than the exposed sagebrush cover, include the subtypes in this classification and enter the appropriate chaparral species symbols. In addition to the color used, hatch areas of this type horizontally with Higgin's waterproof orange ink. This designation also embraces the WOODLAND--SAGEBRUSH that occurs in narrow strips along stream and ravine bottoms, and which is important enough to appear on MAP #1.

*Bunch-waterproof  
get for brush map*



9. WOODLAND--CHAPARRAL. MOSAIC types in which the cover is made up of both WOODLAND and CHAPARRAL (any type of the CHAPARRAL group) species, with each class of vegetation exposed to the extent of 20 percent or more. Where sagebrush species occur to the extent of 20 percent of the shrub cover, but less than the chaparral species, include the subtype in this classification and enter the appropriate sagebrush species symbols. Use the color for the nearest related subtype according to the following guide, and hatch vertically with Higgins' waterproof orange ink. This designation also embraces the WOODLAND-CHAPARRAL that occurs in narrow strips along stream and ravine bottoms, and which is important enough to appear on MAP #1.



*60% ? Bunch waterproof  
orange*

(Dixon's #324) Open stands which consist of three classes of vegetation,--TREES (WOODLAND), SHRUBS (CHAMISE CHAPARRAL, CHAPARRAL, or TIMBERLAND CHAPARRAL), and HERBS (MARSHLAND, MEADOW, or GRASSLAND)--all of which are exposed to the sky. The cover is made up of at least 20 percent TREES, 20 percent SHRUBS, and 20 percent HERBS. In addition to the symbols for the dominant TREE and SHRUB species, include the appropriate HERBACEOUS symbol.



*Bunch waterproof*

(Dixon's #349) Dense stands which consist chiefly of only two classes of vegetation,--TREES (WOODLAND) and SHRUBS (CHAMISE CHAPARRAL, CHAPARRAL, or TIMBERLAND CHAPARRAL)--exposed to the sky. The cover resembles that of the WOODLAND type proper with the SHRUBS interspersed.

 (Dixon's #343) Dense stands which consists chiefly of only two classes of vegetation,--TREES (WOODLAND) and SHRUBS (CHAMISE CHAPARRAL)--exposed to the sky. The cover resembles that of the CHAMISE CHAPARRAL type proper with WOODLAND SPECIES scattered throughout.

*- Barro Colorado*  
 [REDACTED] (Faber's #49) Dense stands which consist chiefly of only two classes of vegetation,--TREES (WOODLAND) and SHRUBS (CHAPARRAL)--exposed to the sky. The cover resembles that of the CHAPARRAL type proper with WOODLAND species scattered throughout.

[REDACTED] (Faber's #14) Open stands which consist chiefly of only two classes of vegetation--TREES (WOODLAND) and SHRUBS (SEMIDESERT CHAPARRAL)--exposed to the sky. The cover resembles that of the SEMIDESERT CHAPARRAL type proper with WOODLAND species scattered throughout.

*- Barro Colorado*  
 [REDACTED] (Dixon's #335) Dense stands which consist chiefly of only two classes of vegetation,--TREES (WOODLAND) and SHRUBS (TIMBERLAND CHAPARRAL)--exposed to the sky. The cover resembles that of the TIMBERLAND CHAPARRAL type proper with WOODLAND species scattered throughout.

*- as is*  
 13 [REDACTED] PINON and/or JUNIPER (Faber's #13) Areas on which 20 percent or more of the vegetation cover consists of TREE species, where either the PINON pines or Juniperus spp. form 20 percent or more of such species.

*- Pin + Pine*  
 14 [REDACTED] MISCELLANEOUS CONIFERS (Faber's #59) Areas on which 20 percent or more of the vegetation cover consists of TREE Species,

where such CONIFERS as Pinus radiata, P. coulteri, P. torreyana, P. tuberculata, P. muricata, Pseudotsuga macrocarpa, Quercus spp., and Abies venusta forming 20 percent or more of such species. Pinus sabiniana is also included in this classification, but only when it is not associated with BROADLEAF WOODLAND TREE species. Associations of these species with the Pinon pines or Juniperus spp., where one of these also occurs to the extent of 20 percent or more, are shown as subtypes of the PINON and/or JUNIPER type.

(g) Commercial Tree Types

Note: In all cases of the following types 20 percent or more of the vegetation cover consists of TREE species. MOSAICS with HERBS or SHRUBS, and associations with BROADLEAF or CONIFEROUS WOODLAND TREES are shown as subtypes of the appropriate COMMERCIAL TREE type. Associations (except FIR) with LODGEPOLE--WHITE PINE species (SUBALPINE TREES) are shown as subtypes of the appropriate COMMERCIAL TREE type. Associations of FIR species with LODGEPOLE--WHITE PINE species are shown as subtypes of the LODGEPOLE--WHITE PINE type. Associations with WHITEBARK--FOX-TAIL PINE species (SUBALPINE TREES) are shown as subtypes of the WHITEBARK--FOXTAIL PINE type.

REDWOOD BELT

15. [REDACTED] REDWOOD (Dixon's #321<sup>1</sup>/<sub>2</sub>) Areas on which Sequoia sempervirens occupies 20 percent or more of the stand of CONIFEROUS TREE species, to the exclusion of 20 percent or more Pseudotsuga taxifolia.

This type also includes all areas on which Sequoia gigantea occurs to the extent of 20 percent or more.

15. [REDACTED] REDWOOD--DOUGLAS FIR (Faber's #39) Areas on which Sequoia sempervirens and Pseudotsuca taxifolia each occupy 20 percent or more of the stand of CONIFEROUS TREE species.

## DOUGLAS FIR BELT

16. [REDACTED] DOUGLAS FIR (Dixon's #350) Areas on which Pseudotsuca taxifolia occupies 20 percent or more of the stand of CONIFEROUS TREE species, to the exclusion of 20 percent or more Sequoia spp., or COMMERCIAL) Finus spp.

## SPRUCE BELT

23. [REDACTED] SITKA SPRUCE (Faber's #59) Areas on which Picea sitchensis occupies 20 percent or more of the stand of CONIFEROUS TREE species, to the exclusion of 20 percent or more Sequoia sempervirens or Pseudotsuca taxifolia.

## PINE BELT

17. [REDACTED] PINE (Dixon's #325) Areas on which Finus lambertiana, F. ponderosa, or F. ponderosa jeffreyi, either individually or two or more together, occupy more than 80 percent of the stand of CONIFEROUS TREE species.

17. [redacted] INCENSE CEDAR (Dixon's #335) Areas on which Libocedrus  
deglutens occupies more than 80 percent of the stand of CONIFEROUS TREE  
species.

Pine Fir Belt

17. [redacted] PINE--DOUGLAS FIR (Dixon's #354) Areas on which PINE  
species and Pseudotsuga taxifolia each occupy 20 percent or more of  
the stand of CONIFEROUS TREE species, to the exclusion of 20 percent  
or more Sequoia spp., or FIR species.

PINE--FIR BELT ✓

18. [redacted] PINE--FIR (Dixon's #354½) Areas on which PINE and FIR  
species each occupy 20 percent or more of the stand of CONIFEROUS TREE  
species, to the exclusion of 20 percent or more Sequoia spp., or  
Pseudotsuga taxifolia.

18. [redacted] PINE--DOUGLAS FIR--FIR (Dixon's #354½) Areas on which  
PINE and FIR species, and Pseudotsuga taxifolia each occupy 20 percent or  
more of the stand of CONIFEROUS TREE species, to the exclusion of 20  
percent or more Sequoia spp.

FIR BELT

19. [redacted] ✓  
FIR (Faber's #22) Areas on which Abies grandis A. concolor,  
A. magnifica, A. magnifica sheetensis, or A. nobilis, either individually  
or two or more together, occupy more than 80 percent of the stand of  
CONIFEROUS TREE species.

(h) Subalpine Tree Types

Note: In all cases of the following types <sup>Where</sup> 20 percent or more of the vegetation cover consists of TREE species. MOSAICS with HERBS or SHRUBS, and associations with BROADLEAF or CONIFEROUS WOODLAND TREES are shown as subtypes of the appropriate SUBALPINE TREE type. Associations of LODGEPOLE--WHITE PINE with COMMERCIAL TREE species (except FIR) are shown as subtypes of the appropriate COMMERCIAL TREE type. Associations of LODGEPOLE--WHITE PINE with FIR species are shown as subtypes of the LODGEPOLE--WHITE PINE type. Associations of WHITEBARK--FOXTAIL PINE with COMMERCIAL TREE species are shown as subtypes of the WHITEBARK--FOXTAIL PINE type.

22. [REDACTED] <sup>T. J. Dixon</sup> LODGEPOLE--WHITE PINE (Dixon's #323) Areas on which either Pinus contorta, P. monticola, Tsuga mertensiana, or Picea breweriana occupy 20 percent or more of the stand of CONIFEROUS TREE species, to the exclusion of 20 percent or more COMMERCIAL TREE species (other than FIR) or species of the WHITEBARK--FOXTAIL PINE type.

23. [REDACTED] <sup>Corren & Semel</sup> WHITEBARK--FOXTAIL PINE (Faber's #32) Areas on which either Pinus albicaulis, P. balfourians, P. flexilis, or P. aristata occupy 20 percent or more of the stand of CONIFEROUS TREE species.

(i) Plantation Tree Types

21. [REDACTED] PLANTATION (Faber's #11) Areas which have been artificially planted to TREES for purposes other than horticultural crops.

This classification includes plantings of COMMERCIAL TREE species for timber crops, such as those set out by the U. S. Forest Service and by lumber companies.

(j) Examples of Type Variations and Symbol Order

The cover consists of the following vegetation:

(1a) Several grass species totalling 70 percent, and 30 percent Artemisia californica. Since the area is predominantly HERBACEOUS, it would be mapped in the GRASSLAND color and the symbols listed: Gr, Ac.

(1b) Several grass species totalling 30 percent, and 70 percent Artemisia californica. Since the area is predominantly SAGEBRUSH, it would be mapped in the SAGEBRUSH color and the symbols listed: Ac, Gr.

(2a) 30 percent Artemisia californica, 20 percent Salvia mellifera, 15 percent Eriogonum fasciculatum, 25 percent Ceanothus crassifolius, and 10 percent Cercocarpus betuloides. Since the area is predominantly SAGEBRUSH, it would be mapped in the SAGEBRUSH color. Only one class of vegetation (SHRUBS) is present, so only those species occupying 20 percent or more of the total cover would be listed: Ac, Ccr, Sm.

(2b) 30 percent Artemisia californica, 20 percent Salvia mellifera, 15 percent Eriogonum fasciculatum, 25 percent Quercus douglasii, and 10 percent Quercus agrifolia. This forms a WOODLAND--SAGEBRUSH MOSAIC and would be mapped in the color and hatching designating that type. Here two classes of vegetation (SHRUBS AND TREES) are present and all species occupy 20 percent or more of the cover taken up by their respective class.

Therefore all of the species would be listed, with the TREES being given first priority: D', A, Ac, Sm, Ef.

(3a) 20 percent each of Cercocarpus betuloides, Ceanothus grassifolius, Rhus laurina, Artemisia californica, and Salvia mellifera. This would be mapped in the CHAPARRAL color with symbols for all of the species included; Cb, Ccr, Kl, Ac, Sm. Ordinarily, where only one class of vegetation (SHRUBS) is involved as in this case, this is the maximum number of species that would be listed in any type area.

(3b) An equal abundance of Cercocarpus betuloides, Ceanothus grassifolius, Rhus laurina, Quercus dumosa, Artemisia californica, and Salvia mellifera. This would likewise be mapped in the CHAPARRAL color with symbols for all of the species included. Cb, Ccr, Kl, Cd, Ac, Sm. Here, although only one class of vegetation (SHRUBS) is involved, six species may be listed, since to eliminate one species on the basis that it does not occupy 20 percent of the cover is to eliminate all species.

(3c) 30 percent WOODLAND species, 40 percent CHAPARRAL species, and 30 percent GRASSLAND species. This forms the open stand form of WOODLAND---CHAPARRAL, and the area would be mapped in the appropriate color and hatched as designated in the legend. All WOODLAND species occurring to the extent of 20 percent or more of the cover occupied by that class of vegetation (TREES) would be listed in the symbol designation. Similarly, all CHAPARRAL species occurring to the extent of 20 percent or more of the cover occupied by that class of vegetation (SHRUBS) would be listed. Unless some conspicuous HERBACEOUS species are present to the extent of 20 percent or more of the HERBACEOUS cover, the GRASSLAND species would be indicated by the general symbol Gg. In such cases there may be more than five or six symbols included.

(4a) 40 percent Arctostaphylos viscida, 35 percent Ceanothus divaricatus, and 25 percent Q. intecarrinus. Since at least one species (Q. intecarrinus) that is restricted to the Transition Life Zone occupies 20 percent or more of the cover, the area would be mapped in the TIMBERLAND CHAPARRAL color and the symbols listed: Av, Cd, Ci.

(4b) 50 percent Arctostaphylos viscida, 40 percent Ceanothus cuneatus, 5 percent Q. divaricatus and 5 percent Ehretia arborescens. As none of the species occupying 20 percent or more of the cover is restricted to the Transition or Canadian Life Zones, and as there is no other definite evidence that the area belongs to one of these zones, it would be mapped in the CHAPARRAL color and the symbols listed: Av, Cs.

(4c) 50 percent Arctostaphylos viscida, 40 percent Ceanothus cuneatus, 5 percent Q. intecarrinus, and 5 percent Quercus kelloggii. More than 80 percent of the cover consists of chaparral species (A. viscida and Q. cuneatus) whose life zone position is intermediate between the Upper Sonoran and Transition Life Zones, and the additional species (Q. intecarrinus and Q. kelloggii), presumably not growing in pockets of better soil, are indicators of the Transition Life Zone. Therefore the area would be mapped in the TIMBERLAND CHAPARRAL color and the symbols listed: Av, Cs.

(4d) 60 percent Arctostaphylos viscida and 40 percent Ceanothus cuneatus; an area of thin soil situated on the edge of the general timber belt. A few individual Pinus ponderosa occur in pockets of better soil. While both the A. viscida and Q. cuneatus are intermediate between the Upper Sonoran and Transition Life Zones, the pines (Transition Zone) would not be used as indicators of the latter zone as they are not growing on the same site. Since there is no definite evidence that the area belongs in the Transition Life Zone, it would be mapped in the CHAPARRAL color and the symbols listed: Av, Cs.

(5a) 10 percent Pinus lambertiana, 20 percent P. ponderosa, and 70 percent P. coulteri. This would be mapped in the PINE color and, since it is strictly a CONIFER association, only those species occupying 20 percent or more of the total cover would be recorded. The symbols would be listed: Y, Cp.

(5b) 10 percent Pinus lambertiana, 20 percent P. ponderosa, and 70 percent Quercus kelloggii. This would also be mapped in the PINE color but, since it is a CONIFER-BROADLEAF association, it would be treated as a MOSAIC and each group considered separately. The symbols would thus be listed: Y, S, B.

(5c) 10 percent Pinus lambertiana, 15 percent P. ponderosa, and 75 percent Quercus kelloggii. Even though neither CONIFER occupies at least 20 percent of the cover as a whole, taken as a group they do. Therefore, this would similarly be treated as a MOSAIC, and would be mapped in the PINE color with the symbols listed: Y, S, B.

(6a) 70 percent Pinus ponderosa jeffreyi, 15 percent Abies concolor, and 15 percent A. magnifica. Neither Abies species alone occupies at least 20 percent of the stand, but taken together as a group they do. Since the FIR constituent of any type is considered as a group, the area would be mapped in the PINE--FIR color. As neither Abies species occurs more abundantly than the other, both would be listed in the symbol designation: J W R. (Two or more commercial pines each less than, but together more than the 20 percent, would be handled similarly.)

(k) Special Cases

1. An abandoned orchard contains 50 percent Af, 25 percent Gr, and 25 percent decadent and dead orchard trees. The area would be mapped in CHAMISE color and the symbol designation would be Af, Gr, (cu). The fact that the area has once been cleared for cultivation and then abandoned

is important for it will show the futility of a repetition of the action. The parentheses will indicate that cultivation has been abandoned.

2. A valley contains a 40 - acre or large type with 25 percent V, of natural occurrence (not planted) and 75 percent cultivated land exposed to the sky. The area would be mapped in WOOLLAND-GRASS color, and the symbol designation would be V, Cu. The lack of parentheses will indicate that cultivation has not been abandoned.

3. In a similar area to 2., V comprises only 15 percent, and cultivated 85 percent. The area would then be mapped in cultivated color, with only the symbol Cu. The trees would be shown on Map #2 as they are important from a natural distribution viewpoint.

4. On the outskirts of a certain town there is an area of over 40 - acres with 25 percent A, 30 percent Ac, 25 percent Gr. and 20 percent Res. The area would be mapped as a WOOLLAND--BARREN type, with the symbol designation A, Ac, Gr. Res.

5. There are certain areas within large GRASSLAND types which support little or no vegetation cover. (These areas occur mainly in the foothills which border large valleys and in high mountain country). The condition may be due to a lack of soil, an absence of sufficient soil moisture, overgrazing or a combination of any of these factors. If the area is permanently barren (due mainly to a lack of soil or toxicity of soil constituents), map it as BARREN type. If the area is permanently SEMI-BARREN, map it as SEMI-BARREN-GRASSLAND type. If, however, the condition is a temporary one (due to periodic lack of precipitation, and/or overgrazing), map the area as GRASSLAND type and make a special overlay showing the boundaries of the condition. In instance of this nature the party leader should contact the field supervisor to check judgment regarding the permanence of the condition.

6. Due to recurrent fires, many species present the problem as to whether young sprout growth represents a tree or a shrub. The mappers decision should be made by observing if the species forms a tree on unburned areas on sites of similar slope, exposure, and soil conditions, in the near vicinity. If the site has been so deteriorated by repeated fires and resulting soil erosion that it is no longer capable of supporting tree forms, the area should be mapped in the appropriate CHAPARRAL color using the symbols for the scrub forms of the species. If, however, the site is still able to support tree growth, the area should be mapped as the appropriate tree type using the symbols for the TREE forms of the species. Among the species which present this problem are Quercus chrysolepis, Q. wislizenii, Q. dumosa, densiflora, Torreya californica, Populus tremuloides, and sometimes Sequoia sempervirens. Where this problem is presented, the party leader will be required to contact the field supervisor for a check on field judgment.

7. Barrenness due to very recent clean burns will be left blank of color, encircled with a solid red ink line, and labeled with the date of the burn also in red. Later, after vegetation has again grown on the area, the type will be mapped in.

#### 4.-COLLECTION AND USE OF EXISTING INFORMATION

##### (a) Instructions for Use

The following maps were made under different standards of accuracy and for different purposes than the present type map. Since they were made, several demands requiring a more intensive system of mapping have arisen. This causes several changes in type classification and field procedure. All these data available, however, should be obtained, taken into the field, and used to every possible advantage.

The principal use of these maps is primarily in the planning of field work. They are valuable as a check on present mapping. Be sure, where differences occur, that the present mapping is correct according to present standards.

Written reports discussing deviations and inconsistencies should be sent in with these maps when they are returned to headquarters. Such reports may aid considerably in subsequent use of these and other maps compiled by each respective agency.

##### (b) Extensive Type Maps

Extensive type maps for several areas are available at Berkeley headquarters. They have been mapped by:

- I. The Forest Service administrative units.
- II. The California Forest and Range Experiment Station.

The basis for type classification has been revised, and more accurate mapping is required since these maps have been made.

##### (c) Forest Service Timber Survey Type Maps

Type maps of several areas of timber land on the National Forests have been made in connection with Forest Service cruises. The type

classification used is not entirely consistent with that at present used on the type map, and species determinations of shrubs and some of the woodland trees are liable to be inexact.

(d) Forest Service Topographic Survey Type Maps

Type maps have been made by the Forest Service engineering department in connection with their topographic survey. Dominant species and mosaic types especially should be intensively checked. Discrepancies in boundaries due to differences in topography are liable to occur.

(e) Forest Service Grazing Reconnaissance Type Maps

Available at the supervisors' offices of some of the National Forests are maps showing meadows and forage value types in detail. A more generalized classification than is used on the type map has been applied in timber types.

Many deviations from our classification occur due to the fact that forage value often affects type delineation. Meadows and cultivated hay fields may, however, be advantageously transferred to the map and then checked for boundaries and location while in the field.

(f) White Pine Blister Rust Reconnaissance Type Maps

Type maps for certain areas have been made by the Blister Rust crews in connection with their reconnaissance work.

This office has followed certain deviations in the setup and classification of types.

- (1) Ten percent by volume sets up a sugar pine type.
- (2) Areas are mapped by public land boundaries.
- (3) No dominant species are listed in any but timber types.
- (4) There is no minute segregation of woodland, woodland-grass,

and woodland types.

*Chaparral*

(g) U. S. Geological Survey Type Maps

In recent years the U. S. Geological Survey have been making type maps in connection with their work. The classification of types is somewhat different from that of the type map, especially in the mosaics. Boundaries of major type breaks should be very accurate.

(h) Private Cruise Records by Dominant Species

Before mapping an area, contact the supervisor's headquarters in order to secure all cruise records available. Using the regular township plats, list, by 40's, the species composition by type as closely as possible. This will aid by helping to distinguish types and species at a distance.

## 5.-FIELD PROCEDURE

### (a) Standard of Work

It is necessary to remember that the reliability of all future assumptions and conclusions to which any analysis of the Vegetation Type Map data may lead is dependent directly upon the character and quality of the field work. Therefore it is of utmost importance that this phase of the job be done strictly according to the general rules set up and with consistency in their application. Remember that rushing any portion of the field work, especially the mapping, may result in a relatively worthless jumble of inconsistent data with the necessity that the entire area be checked or remapped. Do not in any case sacrifice the standard of quality for field progress. The progress report is not used so much in comparison of areas completed between parties as it is for the basis of reporting accomplishments to Washington headquarters, and as a basis for general planning by the office for subsequent field work during the season. If questions arise in the field, record them in a notebook so that they will not be forgotten. Then discuss them all in detail personally with the field supervisor upon his next visit. He is in position to develop the necessary consistency in judgment between the various crews, and thereby may be able to save considerable needless waste of energy and expense. Do not hesitate to discuss all questionable details. Actual examples on the ground offer the best possible checks ~~on the ground offer the best possible checks on judgment~~ and present the best possibilities for the adjustment of judgment to meet accepted standards.

### (b) Size of Areas to be Mapped

Except for the following, do not attempt to map smaller units than 40 acres of any type.

- (1) Remnant woodland and timber types in chaparral areas, or

timber types in woodland would always be mapped if 10 acres or more. If less than 10 acres they should be shown by species symbols on the supplementary map (map #2).

- (2) If it is characteristic that small areas of one type are scattered rather frequently throughout another type and the percent of cover does not justify a mosaic, enough of these areas should be shown on the map to give the proper picture. i.e. (1) the occurrence of brush patches at frequent intervals in a timber type, or (2) the presence of chamise types on ridge crests in a chaparral area.
- (3) Often small cultivated patches, or small grass patches which show abandoned efforts at cultivation may occur in another type. These serve as valuable orientation points in later checking and field reading of the maps, and should be delineated.

However, do not exaggerate the area of these types. Exaggeration leads to misinterpretations from an area basis when the map data is being used.

(c) Suggestions for Mapping

When beginning the season's work, study the entire area thoroughly. Consider the length of time certain portions of the country will be open for field work, condition of roads at different times of the year, pack trips necessary, pack stock available, etc. Then plan the attack as a whole, basing it upon the average working season. Contact with the supervisor, rangers, and local residents is of considerable aid here.

Then plan the immediate attack on the area to be worked first. By the evening before the start of actual mapping, have ready all equipment,

necessary for field work.

Plan the day's work so that there will be good mapping light on types as much of the day as possible. Northerly and easterly exposures are in shadow at the end of the day and westerly exposures in early morning. Do not try to map when types are in shadows.

The character, quality, and quantity of your work will depend to a great extent upon the selection of the best vantage points, both in office planning and in actual field work. Pick out what appear (by topography) to be your best mapping points before you start. Occupy them as early in the day as possible. Don't try to map whole mountainsides from creek bottoms.

During the first few days map slowly, take numerous plots, site indexes, and specimens. Get the "feel" of the country, learn the appearance of species and types from a distance, and check even the slightest possibility for error.

After occupying the vantage point, orient the map by either topography or compass, or both. Check your position as closely as possible. Then pick out the topography on the ground and compare it with that on the map over the entire area you are planning to type. If the topography shown is in major error, correct it roughly on an overlay and sketch in the types.

Sketch in types of smaller area first. Then study subtypes of types of larger area, pencil in the boundaries and fill in the color lightly. Then check areas to see that types occupy the same relative size on the map as they do on the ground. Then enter symbols for all dominants in their proper order. Often, if a large area is visible, it will help to map out one portion completely, and then another. Hereby less erasures are necessary.

Sometimes distances are a trifle too great to distinguish species but not too great to delineate subtypes. If the types are sketched in, certain representative portions checked from closer points, and species checked by plots less time will be required to complete the area than if it were checked up entirely from the first vantage point.

Do not attempt a degree of refinement beyond that of the base map. Confusion rather than increased accuracy results. A case in point is an area where smaller drainages have been omitted from the base map and northerly slopes are chaparral and southerly slopes chamise. The smaller drainages show the same relation between exposure and type as the larger. This situation should be handled by mapping chaparral on the north slopes shown on the map and chamise on the south. Otherwise the map would show both chamise and chaparral on a north slope, and both on a south giving an erroneous picture. On the other hand, avoid lumping. Do not map two distinct types as one mosaic. Try to adjust areas covered by the types in these cases to average about the same on the map as they actually do on the ground.

Constantly check all completed work visible from each vantage point so that errors may be detected and corrected. Large general slopes composed of smaller, minor ridges may have an altogether different appearance when seen from two opposing directions.

From vantage points select positions for sampling by plots and site indices in the areas you have mapped, and mark these selection in pencil on map #2. Plots and site indices if taken in such areas are more representative of broad type conditions and are more valuable in serving the purposes for which they will be used.

Learn the general relationships between slope, exposure, and type in a given locality. Extreme care should be taken in using this knowledge, however, if continual checks are not made, it may be necessary to check the entire map at some later date. Be sure always that you are not mapping areas concealed from view, as behind ridges where types may be radically different.

Before leaving a vantage point, select the next accessible point that can be used most effectively. This procedure will result in better mapping from a minimum number of points with a consequent saving of time and energy.

Continual use of good judgment in all phases of the field work is necessary. The basis for this is past experience and constant checks with the field supervisor who is trying to develop consistency in the job as a whole between the various field crews.

Note: Field procedure on Map #2 and Timber Overlays will be discussed later.

(d) Current Office Work

Keep the office work up to date. Pencil marking wear off easily, and accuracy of the map suffers thereby.

Except for the rainy seasons of the year all office work should be completed at least once a week. Often it is not possible to keep both men busy with office work. This affords an opportunity to give the assistant practice in mapping alone, and aids in the development of his field judgment.

Colors may be set by rubbing with bits of cotton rolled on the end of a sharp stick or with artist fingers, in each case dipped in cerise.

Type boundaries and all symbols must be inked in with Higgin's black waterproof ink. Keep the symbols composing one subtype close together, and near enough to either the vertical or the horizontal that order of dominance is obvious.

If there are questions which arise at this time, and the area is not clearly in your mind, do not hesitate to go into the field to check points in doubt.

When each portion of the map (quarter if a 30' quadrangle; entire map if 15') show an authority diagram somewhere on the margin. The authority diagram should be drawn roughly to scale and show when and by whom portions of the area were mapped--see example.

|   |                |             |
|---|----------------|-------------|
| • | P.L. Johannsen | •           |
| • | May - June     | •           |
| • | 1934           | •           |
| • |                | F.W. Embree |
| • |                | June - Aug. |
| • |                | 1935        |
| • |                |             |
| • |                |             |
| • | A.B. Gifford   | •           |
| • | Oct - Dec.     | •           |
| • | 1931           | •           |

Accompanying each mapped unit (quadrangle) should be a description of all types appearing on the quadrangle. This should not define, but it should give the individuality or characteristics which each type possesses in that particular locality, i.e. height and diameter range of dominant trees in a timber or woodland type, species characteristic of the understorey, litter depth, variations of type with soil conditions, etc. These notes aid considerably in composing the type description for the published map.

### III. SUPPLEMENTARY MAP (Map #2)

#### 1. PURPOSE

This map is to be used for the purpose of showing points of importance in addition to, any detail which cannot be shown on Map #1. (Do not try to show everything on Map #1. The Vegetation Type Map as a whole must be considered complete only with the combination of Maps 1, 2, and 3, sample plots, site indices, specimens and all other data collected in the field.)

#### 2. DATA TO BE RECORDED AND LEGGED

##### (a) Important Additional Species

This map should show important additional species not on Map #1. Presence should be shown by symbol in black ink. If dead, show inside of a black ink boundary.

##### (1) Individual trees

(I) Occurrence of individuals and small groups of trees in otherwise treeless types.

(II) Occurrence of scattered individuals or small groups of ecologically important trees not abundant enough to be shown as dominant on Map #1.

(2) Species at extreme limits of range. Species (either trees or shrubs) of especial importance, the range of which would not be indicated by either the type map or sample plots, and all shrub species which are outside or at extreme limits of their reported geographical and altitudinal range.

(3) Snags indicating that a different type previously occupied the area.

##### (b) Sample Plot Locations

Sample plots, representative of all subtypes, are numbered consecutively on each quadrangle, and are referenced by number to this map.

Plots are shown in black ink, as numbers in black circles.

(c) Site Index Determination Locations

Site index determinations, by actual measurement are numbered consecutively and referenced by number to the map. They are shown as green numbers in green squares or rectangles.

(d) Photograph Locations

Photographs representative of all types and important subtypes encountered are referenced by number to map showing direction they were taken by a red arrow, so that they may be repeated at a later date to show subsequent changes. These are shown as red numbers in red circles.

(e) Fire Boundaries

Boundaries of comparatively recent burns and date burned are shown to give ideas of age class of vegetation present when area was mapped. Clean burns should be so specified. Boundaries and dates are shown in red ink. If it is not possible to discover exact year of burn, indicate a period as (1925-1929) which would include the proper date. If the area is clean burned, and it is possible to distinguish the type previously on the ground, indicate by showing subtype symbols in red ink within the burn boundary.

(f) Lumber Mill Sites

Lumber mill sites, delineated by symbol into live (operating) and dead (old) mills are to be shown in black ink.

(g) Route of Travel

Route of travel while working in country, delineated into that covered on foot (shown by broken line) and that by automobile (shown by solid line) is shown in green ink.

(h) Springs

Springs in areas of general drought should be shown in blue ink.

(i) Small Meadows

Small meadows in areas of general drought should be shown in position by the symbol Md in blue ink.

LEGEND

The following legend is numbered in correlation with the points in the above discussion.

- (a) A - *Quercus agrifolia*  
 B - *Quercus kelloggii*  
 C - *Quercus chrysolepis*  
 (C)- *Quercus chrysolepis* (dead)  
 Anl - *Arctostaphylos nissanana*  
 Cd - *Ceanothus divaricatus*  
 (Cd)- *Ceanothus divaricatus* (dead)
- (b) 96 98 - Sample plot #96
- (c) 35 - Site index determination #35
- (d) 7 - Photograph #7 taken in a northeasterly direction
- (e) 1931 - 1933 surface burn
- 1931-33  
 Af Av 1931 - 1933 clean Af Av burn  
 Burn
- (f)  - Operating lumber mill site  
 - Old Lumber mill site
- (g)  - Route travelled by foot  
 - Route travelled by automobile
- (h)  - Spring
- (i) Md - Meadow

### 3.-COLLECTION AND USE OF EXISTING INFORMATION

#### (a) Fire Boundaries

Usually the forest supervisor or state ranger who administers the area to be mapped has a map record of recent fires and the dates on which they occurred. Contact with these officers will make this data available and use of it should be made. Transfer the boundaries and dates of the larger fires roughly in pencil directly to the supplementary map and adjust the boundaries to topography in the field when the area is being mapped.

#### (b) Lumber Mill Sites

Often, while contacting lumber companies for cutover boundaries it will be possible to obtain data concerning location of old mill sites. These also should be located roughly on the supplementary map and location checked in the field. Conversation with local inhabitants may also provide this data.

#### (c) Road and Trail Maps

Recent road and trail maps may be available through a number of different agencies. Supplementary culture and aid in planning of the work will be obtained by transferring locations of new, and changes in locations of old roads and trails to the supplementary map.

#### (d) Existing Information Regarding Rare Species

Contact with the administrator of the type map herbarium, botany departments of local schools and colleges, nurseries, etc., may disclose the presence of rare species in the locality. Roughly locating the areas occupied by these on the supplementary map will insure an intense check on field observation.

Individual plants of these uncommon species very often occur at rather frequent intervals upon a quadrangle, but are in ecological associations which are typically very small in area. The result is that in many cases they are not mapped or sampled. From the standpoint of plant distribution these individuals are important, and they should be recorded in all cases on map #2. Small associations of this nature are especially frequent in stream bottoms and on ridge tops. In Southern California trees such as M, H, and B, are illustrations of the former, and such shrubs as Qdu, Pm, and many manzanitas illustrate the latter. In such associations, make close observations and list all such species. It is better to have a few too many symbols than too few on the supplementary map.

(c) Photographs

Photographs may have been taken in an area several years before. Studying these pictures, and locating their positions on the map may disclose that impressive data will be obtained by repetition at the date of mapping. Fires, logging, erosion, etc., may have caused vivid changes in the types.

4.-FIELD PROCEDURE(a) Selection of Trees and Shrubs to be Recorded

In treeless types, do not try to enter a symbol for every tree present. What is desired is a picture of average conditions.

When working in the timber belt, the presence of a few ponderosa pine or Douglas fir in a woodland type is not of great importance, but as one proceeds downward to the Lower Sonoran Zone types, the presence of these species really means something and should be listed. At the extreme limits every tree should be shown.

Likewise all species found outside their reported range should be listed here even though they do appear on the plots. A case in point is that of Qd, the range of which was extended considerably when found in Eldorado County. In many localities there, this species would not have been recorded were it not for the symbols on Map #3.

Occasionally a species is considered rare in a certain county or on a quadrangle i.e. California nutmeg in Eldorado County.

(b) Suggestions for Obtaining Information and Recording Data

The crew leader should, at all times, have this map with him in the field. He should plat all the tree and shrub species in order that the proper ones be chosen and that no important ones be omitted. It is advisable that the mapper plat all the data except the plots, site index determinations, and route of travel taken by the assistant. The assistant should plat the data he has obtained on an extra map while in the field and transfer it to map #2 later.

All data should be entered on this map in pencil while in the field.

Dates of burns, if they are not available in written form may often be obtained by questioning some local inhabitants. Another method is to cut off seedlings or sprouts at their ground line and count the annual growth rings.

In locating data on Map #2, preference in position should always be given to plots. If a plot, site index, and photograph are taken in the same area, show the condition with #16 (the plot) directly over the spot where all the data was collected. The boundaries (the square enclosing the site index and the circle of the photograph) should be completed by the boundary of the plot, and all data should be cross-referenced. e.g. 

If two members of a party are working separately, each man should enter his route of travel.

(c) Current Office Work

When other field office work is being done, all data on this map should be inked in with the proper color.

When a quadrangle is completed, somewhere along the margin enter the dates during which the work was done and the names of the individuals who worked it.

#### IV. FOREST RESOURCE MAP

##### 1. THE PUBLISHED MAP (MAP #3)

###### (a) Purpose

The Forest Resource Maps compiled by the Forest Survey Project of the California Forest and Range Experiment Station have been prepared for the purpose of presenting the following two kinds of information:

- (1) The present vegetation cover divided into a few broad classes which are based upon the character of the vegetation from the standpoint of use.
- (2) The character and quality of all lands capable of growing commercial stands of timber.

###### (b) Scope

The Forest Resource Map will not be statewide in scope. It will embrace 137 sheets--those quadrangles containing land commercially important for growing timber stands.

###### (c) Base Maps

The base-maps consist of reproductions of the standard U. S. Geological Survey quadrangles to the scale of 1 inch equals 1 mile, on which the principal towns and streams, county and national forest boundaries, and 1000-foot contour lines are shown. In addition, the land grid is shown for all areas that have been covered by land surveys. Where the original U. S. G. S. quadrangle maps contain the land grid, it is obtained from that source unless there is definite information to prove that it is in error. Where the land grid is lacking, it is obtained from other sources such as U. S. G. S. maps, land office plats, U. S. Forest Service maps, soil surveys, or state, county and private maps. When it is necessary to utilize the latter sources, the best information available is used and the best fit to the topography is made.

In this, the objectives are to place each land unit in its proper location on the topography and at the same time to preserve its actual size and shape as closely as possible. It must be kept in mind, however, that the vegetation and timber data are mapped as they occur in relationship with the topography and without respect to land lines. Another fact to be remembered is that the topography on which the data is recorded is that furnished by the U. S. G. S. quadrangle maps. Thus, where certain topographic features to which the land grid was tied on the source map were not in agreement with similar features on the topographic quadrangle, adjustments were made to place the grid in its proper relationship with the topography as closely as possible without resulting in too great a distortion of the individual land units. It is expected that this procedure will bring the vegetation and timber data into its approximate proper relationship with the land grid, as well as with the topography.

(4) Definitions of Classification and the Legend

These maps will show five broad land classes: (1) forested, (2) watershed, (3) grazing, (4) cultivated, and (5) barren.

(1) Forested lands are further segregated into:

a. VI Virginia timber

Stands of commercial or subalpine tree type that have been essentially undisturbed by cutting or fire; so lightly culled or burned that the virgin stand characteristics have not been removed.

b. UI Young growth timber (Several to many-aged stands)

Stands of commercial or subalpine tree type

that have previously been partially or completely depleted by cutting, or cutting and fire, the present stand consisting of several to many age classes.

C. E: Young growth timber (even-aged stands)

Areas on which the former stand of commercial or subalpine tree types has been entirely removed by cutting or fire, but which at present are being restocked with species of essentially one age class.

(2) a. W: Watershed

Stands of woodland or chaparral types, or mixtures of both which are not restocking <sup>with</sup> ~~the~~ timber and are so dense as to be of little value for other than watershed protection.

(3) Grazing lands are further segregated into:

a. G: Grassland

Areas of grassland proper or dry grassland with an open stand of woodland trees or chaparral or both. Meadows are indicated by the symbol M in the same color.

b. S: Sagebrush

Areas of sagebrush forming the great basin type mainly valuable for grazing.

c. P&/orJ: Pinyon and/or Juniper

Areas of pinyon and/or juniper without species characteristic of forested areas as dominants.

(4) a. G Cultivated

Areas that are cultivated for crops, including those lying fallow, at the time of mapping.

This also includes residential areas which are labeled Res.

(5) a. B Barren

Areas that are practically devoid of vegetation.

All lands capable of producing timber on a commercial scale are subdivided according to site index, or timber producing capacity, the legend being the same as that under the Timber Overlay Site Index, below.

For even-aged young growth timber 20-year age classes and degree of stocking are indicated, the legend again being the same as discussed under the respective headings in connection with the Timber Overlays.

(e) Publication

Although compiled at the same time as the Vegetation Type Maps, these Forest Resource Maps will be withheld from publication awaiting completion of the timber volume estimate, the next phase of the Forest Survey in California. When published, the map margins will contain in addition to textual material descriptive of the various classifications from an economic standpoint, a timber estimate summary by species as applied to the acreages of these classifications found within each county and national forest.

2.-BASES FOR COMPILATION OF THE MAP(a) Vegetation Type Map

The Vegetation Type Map forms the basis for a grouping of types to show the major forest resources in color legend.

(b) Timber Overlays

The timber overlays supply the additional data required to show general stand condition, site index values, age class, and degree of stocking.

on the Forest Resource Maps.

3.- DEFINITIONS OF TIMBER OVERLAY CLASSIFICATION AND THE LEGEND

(a) General Stand Condition

(1) General Definitions

OLD GROWTH designates stands where the majority of the volume is in class 3, 4, and 5 trees (Dunning's classification).

YOUNG GROWTH stands are composed mainly of class 1 and 2 trees.

Old-growth trees which may be present are insufficient in volume to justify present logging even if they are pine or redwood species and are accessible.

EVEN-AGED is applied to young growth stands where the trees are predominantly one age-class; that is, within a range of 20 years.

In a 30-year age-class, for example, the trees may be approximately 30 years old or may vary

from 20 to 40 years with an average of 30 years.

Deforested designates areas from which over 90% of the sound commercial timber trees have been removed but which are, by evidence on the ground, potential commercial land.

#### II.-Specific Definitions

N.T.

N.T. - Non Timber-producing Land

This includes areas ranging from absolute non-forest land to areas within the zone of commercial and potential timber which are too rocky, too steep, or too sterile to produce a stand of commercial size, density, and quality. Timber, if present, may consist of any species, but is not, and is not likely to be of commercial value because of difficult logging conditions, low quality, poor form, and low volume. This classification does not include potentially loggable timber now inaccessible.

##### 1.-Old Growth or Virgin Timber

Stand where the volume of old-growth trees alone (Dunnings classes 3, 4, and 5) justifies logging.

##### 2.-Uneven-aged Young Growth (Selectively Logged Areas)

Residual uneven-aged stands from which most of the old-growth trees, at

least so far as the valuable pine or redwood species are concerned, have been removed by logging. In the mixed-conifer types containing either pine or redwood, the residual stand may contain, in addition to young growth trees, an appreciable volume of sound old growth trees of the so-called inferior species of doubtful commercial value. Profitable present logging for old growth alone is impossible.

### 3.-Uneven-aged Young Growth (Fire Caused)

Unlogged areas where fire has removed most of the old growth trees so that the present stand is composed mainly of uneven-aged young growth trees. Such stands, even if accessible, are not of present commercial value for logging.

### 4.-Uneven-aged Young Growth (Har<sup>k</sup> Beetle Caused)

Unlogged stands similar to No. 3 where the old growth trees have been removed not by fire but as a result of insect killing. Areas of this kind will be mainly found in the east side ponderosa pine types of Modoc and Lassen Counties.

### 5.-Even-aged Young Growth (Outover Land)

Logged areas which have been deforested except for cull trees and which are restocking with young growth essentially of one 20-year age class. The

stand may contain an appreciable volume of permanently unmerchantable cull trees, whose only value has been as seed trees.

6.-Even-aged Young Growth (Fire Caused)

Unlogged areas which have been deforested by fire and which are restocking with young growth essentially of one 20-year age-class.

7.-Even-aged Young Growth (Insect Caused)

Unlogged areas similar to No. 6 which have been deforested as a result of bark beetle epidemics and which are restocking with young growth essentially of one 20-year age-class.

8.-Deforested (Cutover Land)

Logged over lands which have been deforested and which are not at present over 10% restocked with sound commercial timber trees. Areas on which cull trees alone form a timber type are included here, and if these areas are of importance in size, a special note to the effect should be inserted on the overlay.

9.-Deforested (Fire Caused)

Unlogged areas which have been deforested by fire, and which are not at present over 10% restocked with sound commercial timber trees.

10.-Deforested (Insect Caused)

Unlogged areas similar to No. 9 which have been deforested by bark beetle

killing and which are not at present over 10% restocked with sound commercial timber trees

(b) Site Index

Site Index, or the height attainable by the average dominant trees at 300 years, is divided into 25-foot classes, and represented by the number indicating that height. It is an index of soil productivity rather than solely a measurement of the stand which may actually be on the area. An exception is found in commercial subalpine types embracing such trees as Lodgepole pine, Western white pine, and Mountain hemlock. In this case an average site index is applied to the group as a whole. In cases, however, where red or white fir appear as dominants in this belt, a regular timber site index is assigned to the area.

| <u>Symbol</u> | <u>Site Index</u>              |
|---------------|--------------------------------|
| .1            | 75                             |
| .2            | 100                            |
| .3            | 125                            |
| .4            | 150                            |
| .5            | 175                            |
| .6            | 200                            |
| .7            | 225                            |
| .0            | Lodgepole, White pine, Hemlock |

(c) Age Class

Age class is subdivided into 20-year intervals.

| <u>Symbol</u> | <u>Age Class</u> |
|---------------|------------------|
| 1.            | 0-20 Years       |
| 2.            | 21-40 "          |
| 3.            | 41-60 "          |
| 4.            | 61-80 "          |
| 5.            | 81-100 "         |

(d) Degree of Stocking

Stocking is subdivided into 30 % classes as based upon the amount of utilization of the available crown space.

| <u>Symbol</u> | <u>Stocking</u> |
|---------------|-----------------|
| .1            | 71-100%         |
| .2            | 41-70%          |
| .3            | 11-40%          |

Under 11% of the available crown space utilized is considered non-stocked.

(e) Application of Definitions

These timber overlay data are mapped on vellum sheets in the field, superimposed over the Type Map, and are applied, as are the types, to topography.

General stand condition and site index are applied to all lands capable of producing commercial timber.

Age class and degree of stocking are applied to all even-aged young growth stands.

Whole numbers designate the appropriate stand condition as shown under that legend. Decimals indicate the appropriate site index. In even-aged stands, age-class and degree of stocking are similarly shown as whole numbers and decimals respectively but as the denominator of a fraction.

(f) Examples

1.4 represents an old growth stand of site index 150.

3.3 represents an uneven-aged young growth cutover stand of site index 125

8.7 represents a deforested cutover non-restocking area of site index 225.

5.6 represents an even-aged young growth cutover area of site index  $\frac{200}{1.1}$ , restocking with second growth aged 0-20 years and which utilizes from 71-100% of the available crown space.

Areas representing one combination of conditions are enclosed by a single solid black ink line on the overlay sheets.

4.-COLLECTION AND USE OF EXISTING INFORMATION

(a) Cutover Boundaries and Dates of Cutting

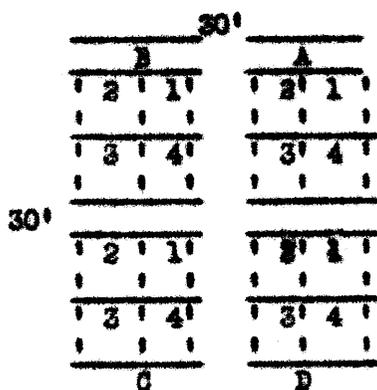
Contact with head offices of all lumber companies, mills, forest service administrative organizations, and state rangers should be made for the collection of all data available on previous lumbering operations. This data should be recorded on the regular 1 inch to mile township plats showing areas cutover and dates cut. (See Example form.) The cutover boundaries should be transferred roughly to the field timber overlays before mapping, classified and adjusted to topography, while in the field.

5.-FIELD PROCEDURE

(a) Designation of Overlays

Minute lines should be used for orientation of the overlays, serving to allow them to be superimposed over, and used directly with the type map.

Label all overlays in the upper right-hand corner, using the following system:



i.e. Overlay which cover portion with double blue line is numbered  
Chico B3

Overlay which covers portion with single blue line is  
Chico D2

Keep these timber overlays clipped to the type map and properly oriented so that they are always ready for use. Do not destroy the field copies. Send them in with the office copy.

(b) Stand Conditions

Application of these definitions in the field requires considerable judgment which can be acquired only by experience and practice. It is, therefore, necessary that a new mapper have frequent contacts and discussions on the ground with the field supervisor.

(c) Site Index Determination

These determinations are the basis for the mapping of areas of site index on all so-called commercial timber land. Measurements are taken on representative commercial timber trees of the subtypes and applied to areas of similar conditions.

## (1) Measurements required:

Ht. The height of the tree is measured from its base to extreme tip with an abney hand level. A distance of 50, 100, 150, or 200 feet from the base of the tree is measured with tape or chalk line. Distance from the base of the tree should be great enough that the reading on the arc of the abney will be less than 100. This arc of the abney should be set in percent, so that but simple calculations are necessary to obtain the actual height.

Diag. Diameter of the tree is measured at breast height (a point 54" above the average ground line).

Age The age of the tree is then measured. An increment borer is used and the measurement is taken at breast height. The age required for a tree to attain breast height is determined by cutting seedlings of breast height at the ground and counting their growth rings. Since the variation in ages of these seedlings is usually not greater than 4-8 years in any locality, and depends to a great extent on site conditions, estimations can be made after several determinations during the beginning of field work in the area.

With second growth trees, the increment borer is usually long enough to reach the center of the tree and the total age is easily obtained by counting the growth rings on the core and adding the age of breast high seedlings.

With mature trees, however, this is often not the case. With the older (class 5)\* trees it is sufficient to ascertain approximate age only. This may be done by either counting the rings on as long a core as it is possible to obtain and estimating the number of rings for the remainder of the growth radius, or by making ring counts on stumps of similar trees on nearby cut-over areas. Enclose all estimated figures in parenthesis.

All these cores should be labeled in indelible pencil on one side with Site Index determination number, species of tree, position in stand (D dominant, C codominant, X isolated), diameter and height, and quadrangle. On the other side the core is marked off in inches from the inner bark to the center. The number of rings within each inch are then entered, each within the boundaries of that inch. All cores should be labeled in the field immediately upon extraction - not later on office days. If the inches of radius are not marked on the fresh cores, shrinkage makes these measurements meaningless. These cores are kept in boxes by quadrangles and returned to headquarters with the other data. If the core must be broken into two pieces to fit in the box, number both parts so that they may be placed together when making further studies from them.

\* See "A Tree Classification for the Selection Forests of the Sierra Nevada" by Duncan Dunning (copy enclosed in envelope page--)

## (2) Number to be taken:

Numerous site index determinations should be taken when first starting work in a new locality. This done to develop judgment in correlation of site index with soil character, thriftiness of trees, and other conditions on the ground. Later, as good judgment develops for a certain locality, estimation may be used if frequent determinations are taken to constantly check this judgment. In any case, the determination should not be farther than  $2\frac{1}{2}$  to  $3\frac{1}{2}$  miles apart if so-called commercial timber land intervenes.

## (3) Selection of representative trees for measurement:

Except for deforested areas where isolated trees must frequently be used for site index determination, select an average dominant of its age class (not the tallest of the group). Great care is necessary to avoid trees which have been suppressed in their earlier years, and also to avoid those stimulated in growth due to proximity to some small gully or stream. Suppression is often apparent by observing short internodes at the base of the crown, or, if these lower branches are absent, the increment core itself may indicate suppressed growth. If suppression is in any way apparent, another tree should be selected.

Avoid selection of trees injured by natural or mechanical agencies as much as possible.

In second-growth even-aged stands it is best to select a second-growth average dominant tree (crown class 1).

In a residually-logged or virgin stand select preferably a thrifty mature or, if none is available, an overmature (crown class 3 or 5 respectively) tree.

In deforested areas usually only isolated trees are available and they are often of inferior value as representatives. Here experience and judgment are necessary in adjustment of the allotted site index to the area, (due to the fact that it is soil productivity we are trying to measure. Tree heights on the area are the closest indicators of this factor, but representative trees may have been entirely removed.

It is preferable to select ponderosa pine in the pine or pine-fir belts, Douglas fir where that species predominates, and either red or white fir where they, respectively, predominate. In the case of #22 types where red or white fir are dominants, they should be chosen representative trees.

Use Dunning site index curves (Region 5, PP, SP, DF, and W Dominants) in pine and pine-fir belts, the Douglas fir curve where Douglas fir predominates, white fir curves where that species predominates, and red fir curves where it predominates.

(4) Instructions for filling out form

| Spe-:Site : | Age :  | Diam. : | Ht. : | Class : | Sub-:Type : | Associated: species :  | Elev. : | Slope: per-: cent : | Expo-: sure : | Soil : | Remarks : |
|-------------|--------|---------|-------|---------|-------------|------------------------|---------|---------------------|---------------|--------|-----------|
| Y : 175-    | 45+(5) | 18.4    | 81    | 1       | Yd          | S, B, W, Av, Cc, Rd    | 3000    | 25                  | Ne            | Clay   | Plot 4    |
| D : 150+    | 51+(7) | 15.9    | 69    | 1       | DW          | S, B, M, Cl, Pta       | 3400    | 60                  | SW            | Sandy  | Dense W   |
| W : 300     | (400)  | 68.0    | 218   | 5       | ApB         | S, Y, W, G, Cc, Cl, Pe | 4000    | 45                  | N             | Sandy  | Plot 7    |
| W : 175     | 267+   | 49.7    | 132   | 5       | WR          | S, G, W, Atr, Chh      | 5600    | 30                  | E             | Rocky  | Type quit |

Number and list all site index determinations consecutively.

Enter, by symbol, the species of tree selected and measured for site index.

List the site index value as determined from the appropriate set of site index curves. If it is a strong value (if the point falls well above curve but still is not the site index above), indicate by a plus (+) after the value as with #3; likewise, if it is a weak value, indicate by a minus (-) after the value as with #1.

In listing age, enter the actual count of rings on the core separate from the age to breast height and the estimation of the number of rings for the remainder of growth radius, as 48, 51, and 257 in site index determinations numbers 1, 2, and 4 respectively. Then show the age additional to this by plus (5), (7), (400), and (100) with site indexes 1, 2, 3, and 4 respectively.

Diameter should be recorded to the nearest tenth of an inch.

Height should be recorded to the nearest foot.

Crown class, according to Dunning's classification, should be recorded.

Subtype should be shown by listing the species which occur as dominants.

In listing associated species preference should be given to trees, and only those species in addition to dominants, and which are characteristic of the subtype, should be shown.

Record elevation of location where Site Index determination was taken.

Measure the slope percent with an alney until practice results in good judgment in estimation, then check frequently.

Exposure should be measured with a compass, and listed as one of the eight major points; N, NE, E, SE, S, SW, W, and NW.

List significant characteristics of the soil as to texture as it is done under "Character" on the plots.

List under remarks any important characteristics of the subtype not brought out elsewhere. If the site index determination is taken with a sample plot, list plot number here as with numbers 1 and 3.

(d) <sup>Age Class</sup> In most cases, age class may be determined in connection with the site index determination. In border line cases, however, adjustment must be made due to the fact that the average dominants may be a few years older than the stand as a whole.

An exception to the above is the case of stands which, prior to cutting consisted of mature and over-mature trees with a very much suppressed understory of reproduction essentially even-aged. Because of this suppression, the age of the stand left by the clear-cutting is much greater than a normally grown stand of the same height. For example, a stand averaging eight feet in height and which normally would be age class 1.- (1-20 years) may be found to be class 3.- (41-60 years). Since our yield tables are based on normally grown stands, the classification as age class 3. is of no practical value. Its classification as age-class 1. will permit the prediction of future yields from the yield tables. In cases of suppressed stands of this kind, therefore:

- (1) Determine the site index for the <sup>area</sup> ~~idea~~ involved.

- (2) Determine the average height of this stand by measuring an average dominant.
- (3) Using height and site index, assign the stand to the age class indicated by the appropriate site index curve.

(e) Degree of Stocking

Judgment in allotting degree of stocking can be gained by a new mapper only by thorough sampling. After good judgment has been developed, frequent checks, especially in border-line cases, should be made.

These checks should be at least three sample plots in length, treating the canopy exposed to the sky. Incidentally, this method of sampling is a good check of type mapping and should be used where questions arise in the case of mosaic types.

Small openings, a few acres in size, occur throughout most second growth stands. These should be considered in assigning the degree of stocking to the area. In other words, if the density of the second-growth timber where it occurs falls just within the .1 or (71-100%) class, and several of these openings appear, the stocking assigned the area should be the 2 or (41-70%) class.

Degree of stocking should be listed considering only those trees indicated by the age class. In a 5.5 the .2 stocking classification applies only to the 4. age-class and does not include the <sup>4.2</sup> <sup>other very young</sup> ~~old~~ growth timber. In types other than timber types which are restocking, show on the timber overlay symbols for the commercial species which are stocking the area.

(f) Size of Areas to be Mapped

Within any area of a given stand condition, site index, age class, or degree of stocking, do not delineate small areas which differ slightly from the major classification. It is expected that these are present, and an

attempt to map them will result in a confusion of useless detail. Areas of major deviation, however, as a  $\frac{5.4}{3.2}$  in a general 2.4 area should be mapped if 10 acres or more in size.

(g) Suggestions for Mapping

From every mapping station complete the timber overlay for the same area as has been mapped on MAP #1.

Draw in stand condition, age-class, and degree of stocking boundaries first. Contiguous areas of the same classification may be joined when the area is completed.

Note the site index as determined by actual measurements at every mapping point, if a representative tree can be found there, and also those indices previously taken through the area just mapped. Then sketch in site index boundaries wherever a change is evident. In this mapping, remember that site index quality usually does not change in any locality without reason. Usually it is obvious that a change in site index is directly correlated with a distinct change in soil character, elevation, slope, exposure, or the like, which are in turn frequently also accompanied by a change in type or subtype. For this reason it is common to find site index boundaries coinciding with type or subtype boundaries.

Meadows will all be considered N.T. areas unless they are definitely allotted a site index on the timber overlay.

(h) Site Index Determinations in Southern California

In southern California certain areas of commercial timber stands appear. Their recreational value far surpasses value as timber land and therefore no timber overlays are made in connection with the mapping. Site index

determination measurements, however, are taken to give a general representation of timber growth where it occurs. Only enough determinations will be required to show the range and importance of site index values for any locality.

(1) Current Office Work

For a permanent record, the stocking, age-class, and site index data are transferred from the field overlays to properly labeled office copies on tracing cloth upon which minute lines are shown in red ink. The boundaries and numerical representations of stand conditions, age-class, site index, and degree of stocking are inked in black. This office copy should not be used in the field. It should be kept up to date concurrently with other field office work.

## V. SAMPLE PLOTS

### 1. PURPOSE

Since the basis of type mapping is the vegetation exposed to the sky, understory vegetation cannot often be shown except in grassland and mosaic types. Also there is considerable detail in the composition of the exposed vegetation which cannot be shown on any of ~~the maps~~. The sample plots are designed to show these omissions and complete the entire picture of vegetation on the ground.

The plots serve as a check on the mapper's field judgment and assist him in an understanding of types. They are used immediately in the field for this purpose.

The sample plots are designed primarily, therefore, to give accurately the important characteristics that have a bearing on fire hazard, run-off and erosion, timber and/or fuel values, and grazing value for each major subtype. The plots will be used for statistical analysis in these connections.

### 2. COLLECTION AND USE OF EXISTING INFORMATION

#### (a) Geological Maps

Overlays showing major geological formations are available at Berkeley headquarters for a number of U. S. G. S. quadrangle units. These

should be used both in the office and in the field as a check on geological data for the plots.

(b) Fire Maps

Fire maps available and data from fire maps should be used in the office to record and check the year of last burn on the plot sheets.

3. FIELD PROCEDURE

(a) Number of Plots to be Taken

The man assigned to the task should take as many carefully chosen sample plots each day as time permits. When both parties map, each should take

plots. Sixty to ninety plots per 15' quadrangle (roughly 2½ to 2¾ miles apart) if they are properly chosen, should accomplish the desired result as discussed below. It is possible to stress this portion of the job too much; do not sacrifice too much mapping time in waiting for plots to be taken.

(b) Types to be Sampled and Plot Selection

All but Barren types, Cultivated types, Plantation types, and grassland types under 120 acres in size are to be sampled. Plots should be distributed so that they cross-section each major subtype encountered. The larger the area of any subtype and the greater its typical variations, the more plots are required. All minor variations, however, should not be sampled; it is a good representation of major typical variations which is desired.

Sample plots should be selected so they are within the exterior boundaries of a well-defined natural association and not with the preconceived idea that certain species should be included in the sample area. The latter defeats the purpose of random sampling. The mapper uses the plots as guides only in determining dominants to be designated on the map. There need be no concern if the dominants shown by the random plot are not in full agreement with those obviously indicated for the association as a whole. In such cases the mapper's judgment, rather than the sample prevails.

(c) Instructions for Taking Tree, Shrub, and Ground Cover Plots

Tree, shrub, and ground cover plots are to be taken using form GFES 1 ~~same~~ in all types but grassland and areas recently clean burned. They are to be numbered consecutively, starting anew for each quadrangle.

In woodland-grass types and woodland-chaparral-grass subtypes, the abundant herbaceous species are to be listed in order of relative abundance. List these species in the summary column opposite in position to where the

symbol Gr or Ann has been placed. (See example).

In gently rolling or flat country, the center line of the sample plot follows a cardinal direction (N. S. or E. W.) measured by the compass, and is recorded in the left margin of the sample plot form as shown in the example plots. In steep country, the center line of the sample plot is at right angle to the contour and the fact is shown in the left margin of the sample plot form.

Care should be exercised to select an area typical of the local type. (Not a transition between two types.)

Any species with which the recorder is unacquainted should be given his field specimen number for temporary field determination, collected and sent to Berkeley for identification.

Selection of typical areas for sampling is often difficult. One good method is to observe, while mapping an area, typical portions of the variations of types which are the most easily accessible. Then on Map #2 indicate these positions by pencil crosses, and take plots there later.

If one man is mapping and the other taking plots and other data, considerable planning is necessary to develop efficiency in time spent so that there will not be too much waiting. It is therefore necessary to consider proximity to mapping points and accessibility in this selection of positions for plots.

(d) Instructions for Taking Herbaceous Plots

Herbaceous plots are to be taken, using form GFES #2 alone, only in grassland types (including grassland, large meadows, perennial herb and marshland subtypes.) They are to be numbered consecutively in the same series with all other plots.

The large areas of grassland types occurring in the foothills and valleys will not be sampled by the field mapper. Trips from the office will be made in the spring season for the expressed purpose of sampling these areas. The field mapper should, however, sample the larger sized grassland types which are isolated in position.

Before making the trip from the office to obtain sample plots in the large grassland types, make the following preparations.

On a series of vellum overlays for each quadrangle to be sampled, locate the sample plots already obtained. Then, with another symbol, locate

the points at which additional plots should be taken in order to get the desired distribution. When in the field, necessary changes in these predetermined locations may be made to save time by sampling at more accessible points. Proper distribution, however, should always be obtained.

It is desirable, as with other types, to get an even distribution of plots  $3\frac{1}{2}$  to  $3\frac{3}{4}$  miles apart. However, except in particularly interesting cases do not take plots in grass types which are less than 120 acres on 15 minute quadrangles or 480 acres on 30 minute quadrangles.

Unknowns should be treated as with other plots.

Selection of typical areas for grass plots is not possible from any great distance. It is usually necessary to be in the area.

(c) Instructions for Taking Plots in Recent Clean Burns.

Plots similar to those taken in grassland areas should be taken in all fairly recent cleanly burned-over shrub types where herbaceous vegetation is temporarily predominant. Form C722 #2 alone changing the headings of the columns "shade" and "open" to "sprouts" and "seedlings".

All unknowns should be collected, even though they may be indeterminate at the herbarium.

Concentration of a greater number of plots than is usual with other types (1 - 2 miles apart) is desirable in these areas, in order to have a record of all herbaceous vegetation present as they are to serve the purpose of reconnaissance and data for successional studies.

Plots should be numbered consecutively and in the same series with all others.

It may also be desirable to supplement these plots with a more detailed write-up for each major burn, discussing personal observations in addition to the points covered by the plots.

(f) Instructions for Filling Out Plot Forms

(1) Data to be recorded on all sample plot forms.

Plot number should always be filled out in the field to correspond to number used in showing location of plot on Map #2.

Quadrangle name should always be entered in field.

Elevation should be recorded to the nearest figure allowed by the topographic map. Recording the elevation should be done as office work.

Location of plot with respect both to public land boundaries (section, township and range), and geography (mountain, stream, town, etc.) should be filled in, preferably while doing office work. Geographic reference should be made only to points whose names appear on the topographic map.

Name of person taking plot should be recorded in field.

Date plot was taken should also be recorded in the field.

Type should be recorded in the field by the symbols which define the mapped subtype and should agree even though species on the plot may indicate that the plot is not exactly representative of the subtype as a whole. For example, after taking a plot, it is discovered that there is 50% Af, 30% Av, 15% Cc on the sampled area. The symbols of the dominants for the entire association as it has been mapped on Map #1 appear as Af, Av, Cc. In designating "type" on the back of the plot sheet all the symbols Af, Av, and Cc, should be entered in spite of the fact that Cc occupied only 15% of the squares on the front. The purpose of this procedure is to afford an easy means of segregating all the Af, Av, Cc plots from the entire lot for

the quadrangle. Then the face of the plots will show the variations for that particular subtype.

Exposure as N, NW, W, etc. (8 points of the compass) should be measured with the compass and recorded in the field.

Slope should be estimated to nearest 5 percent and recorded in the field. Estimation should be checked with the alney until the ability to judge is developed. Frequent checks on judgment should be applied later.

Year of last burn should preferably be listed in field. If there is a question, list date as closely as possible, i.e. "between 1930 and 1933", and try to find out later when the last fire on the area occurred.

Site Index, if a determination was not taken with the plot, should be estimated and recorded in the field.

Penetrability should be indicated in the field by checking one of the following:

Easy - little or no resistance

Medium - progress somewhat retarded

Difficult - progress decidedly retarded

Impenetrable - progress practically impossible

Depth of soil should be indicated in field. The actual depth in feet of the soil is determinable only in the vicinity of road and trail cuts, deep erosion gullies, landslides, etc. In the classification here, however, it is not intended that the actual footage listed be rigidly interpreted. Very shallow and very deep soils are usually obvious, but the borderline cases between both of these and the "medium" classification is often difficult. By a process of continued observation of definitely known cases (road cuts, erosion gullies, landslides, etc.) consistent estimation may be developed. Where there is doubt, check the designation most applicable, and circle the check mark.

Character of soil should be indicated in the field by checking all terms necessary. Terms should be checked, however, only when characteristics are very obvious.

Origin of soil should be recorded in the field and checked with the geological overlay later while office work is being done.

In field identification first decide whether the rock is igneous, sedimentary, or metamorphic.

Under igneous rocks differentiate between Volcanics and Plutonics. Under the Volcanics check "basalt" if the rock is basic (dark brown to black in color), and "felsite (rhyolite should be the term used as the typical, but felsite is a type of rhyolite) if the rock is acidic. If the rock has a porous structure check "tuff" in addition. Under the Plutonics likewise differentiate between the acidic and basic groups, checking "gabbro" for the basic, and "granite" for the acidic, again using color for determination. (Gabbro is the only basic plutonic rock -- all the rest are acidic.) Then if a porphyritic texture is present, also indicate that fact.

If the rock is dark and glassy, check "obsidian".

Under the sedimentary rocks, differentiate between alluvium, sandstone, conglomerate, shale, and limestone. If any sandstones, shales, or conglomerates are calcareous (cemented with or contain lime), indicate the fact in the blank spaces under "sedimentary". In alluviums, if possible, indicate the parent rock from which the material was transported.

Under the metamorphic rocks, differentiate between slate, schist, gneiss, serpentine, and quartzite.

Additional ground cover species which do not appear in summary, but which fall within the boundaries of the plot should be shown by species symbol, and abundance should be indicated as follows:

x - occasional  
 xx - frequent  
 x  
 xxx - abundant

Under remarks, record any important characteristics of the subtype not brought out by the sample plot i.e. numerous small semi-barren areas due to erosion; small areas of pure chamise spotted throughout the subtype, etc. Also list here other additional species characteristic of the subtype, but which do not fall (within the boundaries of the sample plot area.

(2) Filling out tree, shrub and ground cover plot form (Form CIPES 1).

The rectangle enclosing 100 squares corresponds to an area on the ground 2 chains long and  $\frac{1}{2}$  chain wide. Each square represents a milacre (a 6.6 foot square). The recorder centers himself in the initial square of the middle tier and picks a point ahead to determine the directions of the strip. Next, he records, by symbol, the species that dominates the square in which he is standing. If the species is dead, its symbol is enclosed in parenthesis. Looking to the right 10 feet, he records the species dominating the adjacent square. Then looking  $16\frac{1}{2}$  feet to the right outer edge of the plot he records the species dominating the outer square. This he repeats on the left. Then stepping ahead 6.6 feet he repeats the process, and so on until the 100 squares covering the  $\frac{1}{10}$  acre area are all recorded.

Where a coniferous seedling is present in any square, but not dominant, this information is recorded using the proper symbol in the upper half of the corresponding square on the plot form, in addition to the dominant species present. (See example plot.)

Where any seedling or group of seedlings of one species dominates a square, enter the symbol for that species in the square.

Where less than 50 percent of any square is brush or grass covered, the character of the ground surface is indicated as follows:

Ba - Barren area

⊗ - Rock outcrops prohibiting vegetation

Lit - Litter. Measure depth. Indicate species from which derived, i.e. C Lit. If litter is composite, label square Lit, and mention the group of species from which it is derived.

⊙ - Tree trunk

Ann - Annual herbs

Leave no square blank. One "√" per plot, but only one, and no other hieroglyphics, may be used to represent a symbol. In all cases, record above the summary table just what symbol the "√" represents.

As soon as a species dominates a square, enter it in the summary column.

Also record in the summary while taking the plot:

Average heights, to the nearest half foot, for each species.

Consider here only the individuals composing the greater percentage; not the extremes. Do not list range in heights.

(In the springtime list annual herbs and grasses to the nearest 1/12 foot.)

Average litter depth (litter plus duff plus humus) to mineral soil for each species. In the summary column this applies only to the litter laid down by that particular species. List depth to a lower limit of 1/8". If under 1/8" enter x to indicate that there is only a trace. If there is no litter, show a ZERO in the summary column. If there is a composite litter under the bush, list the several species composing the litter, and average litter depth for the entire plot under remarks. For example, consider Cf in a YW, Cf type. The Cf will add but a negligible amount of litter to that on the ground. In this case, 0 is shown in the column for litter depth after Cf and a note is added under remarks--see example plot.

In all types where trees over 4" D.B.H. occur they are tallied by means of a cruisers' square by species and D.B.H. classes. For this tally, however, the strip is one chain wide, the middle line of which coincides with that of the rest of the sample plot. This gives an area of .2 acres. The total height (from base to tip) of the average dominant trees of each species is recorded in the height column. The <sup>height</sup> figure here is estimated, but frequent checks by actual measurement with the abney hand level and pacing are made.

(3) Filling out herbaceous plot form. These plots are approximately 5 chains in length and half a chain in width. Listed on the plot sheet are several genera and species of grasses and herbs. Also several blank spaces are present in which the names or symbols of other species are entered.

The recorder estimates some point approximately 5 chains ahead for size and direction of the plot. He then walks through the plot listing every species present. By a single oblique stroke of the

pencil from upper right to lowerleft corners of the square in proper column, the recorder indicates whether the plants occur in the shade, in the open, or both. When a plant is abundant, the recorder crosses this oblique line by another from upper left to lower right corners of the square again in the proper column. Be sure a species is abundant before listing it as such; there are seldom more than 4 or 5 abundant species per plot. Then, if there is an obvious sequence in the order of abundance, this is shown by entering number, 1, 2, 3, etc., over the cross. If there is no easily obvious order of abundance, no numbers are entered.

In the above plot sheet then, the principal species in order of relative abundance in the shade are *Bromus tectorum*, *B. rigidus*, and *Medicago hispida*. Those in the open are *Bromus rigidus*, *B. tectorum*, and *Avena barbata*.

(4) Filling out form for plots in recent burns. Exactly the same procedure is used in filling out the form for recent burns as is used with herbaceous plots. The columns labelled "shade" and "open", however, are changed to "sprouts" and "seedlings", and species are shown separately under these headings just as before. Relative order of abundance of the dominants, when obvious, is also shown as before, except that sprouts and seedlings are not separated in this consideration.

(5) Current Office Work

At least once each week, when the other field office work is being done, all office work on the plot sheets should be brought up to date. This includes:

1. Totalling percents in summaries of forms CPES 1.
2. Totalling trees in tree tally.

3. Inking of numbers to show relative dominance in both herbaceous and burned plots.

4. Entering locations, and elevations in headings of all plots.

5. Checking (Parent rock) designation, with geological overlay, and year of last burn with data on burns.

6. A general check of each plot to be sure that no data has been omitted. Do not leave any points in doubt. If you are unable to determine any factor, enter a question mark in the proper position to indicate what you think, even though you are not sure. If there is no litter for a certain species, enter a zero in proper place to impress the fact that the point has not been overlooked. Do not leave it blank.

7. Change all specimen numbers used for recently determined unknowns to the appropriate symbol for that species.

## VI. HERBARIUM

### 1. PURPOSE

The herbarium is becoming increasingly valuable to the Vegetation Type Map Project, not only because its increase in size, but also because of the accumulation of valuable data which applies directly to the specimens themselves. The herbarium affords an opportunity for the study of numerous specimens from various parts of the state, each of which is accompanied by relatively comprehensive field notes concerning its habitat, including a mention of many of the species found growing associated with it. As it increases in size it is of ever increasing value not only to the Project itself but also to others engaged in the study of the vegetation of California. This would result in an increased public interest in the Vegetation Type Map itself.

Among the direct purposes of the herbarium are:

1. To constitute a permanent proof supporting the record of the occurrence of species on each quadrangle and to confirm the field identification made by the mapper.
2. To assist the mapper to become better acquainted with California plants, their ecology, and their distribution so that he may carry on his work more efficiently and intelligently.
3. To afford information as to the ecology of each species, including information as to the exact locality where it was collected and the plants found associated with it.
4. To add to our knowledge concerning the geographical range and distribution of California plant species.

In the long run this may constitute one of the most important scientific contributions of the Project.

5. To afford information regarding possible economic uses such as the value as forage for grazing animals, possible uses for erosion control, etc.

6. To add to our knowledge of Common names of California plants.

## 2.-COLLECTION AND USE OF PRELIMINARY INFORMATION

Before starting into the fields, the party leader shall contact the administrator of the type map herbarium. There he shall obtain the information possible regarding species on the area he is to map.

### (a) Study of Specimens of Common Species to be Encountered.

Often many of the species likely to be encountered may be new to a particular mapper. A study of herbarium specimens of species common to the area may save considerable time in the field due to the fact that many may be identified on sight without having to run down in the botanical key.

### (b) Notes and Observations on Unusual Species Likely to be Encountered.

Information regarding local or restricted distribution knowledge of incomplete data on range, unconfirmed reports on occurrences, and other interesting points may be available through this source. These points should be discussed at this time, and all detail in question noted. Then, when in the field, thorough observations should be made so that no detail is overlooked. All data should be confirmed by actual specimen collection. Be sure that all records in this connection are completed on the ground so that no errors are likely to occur.

### 3.- FIELD PROCEDURES

#### (a) Species to be Collected

##### 1. Specimens required.

It shall be the important duty of each field <sup>party</sup> to collect specimens of all species whose names are recorded on the type map itself, on the individual tree map, and on the sample plot sheets. In addition it is important that specimens shall be collected from any plants when found near the limits of their ranges and especially when found beyond their recorded range. It is most necessary that perennial grasses be collected whenever practicable since it is believed that they may prove to have considerable value as indicators of site conditions. It is also important that all poisonous plants be collected. Collections should be made of any species which is known to be of very local or restricted distribution.

##### 2. Specimens Desired

It will be greatly appreciated if as extensive collections are made as is feasible of native plants other than those mentioned above, but such collections should not be made at the expense of efficiency in other phases of the work nor to the extent that the botanical work may become unduly burdensome to the field staff. The more purely scientific value of the herbarium will be greatly enhanced by the collection of as many plants encountered as possible. The Vegetation Type Map Project has an exceptional opportunity to contribute to the knowledge of the California flora. This should not be neglected.

### 3. Special Collections (Seedlings, Plants in Winter Condition, Sprouts)

It is necessary that much of the field work be done during the winter or at times when many species are not in flower or fruit. Since identification of seedlings or of specimens lacking flowers, fruits or leaves is often difficult and in many cases can only be made after comparison with named specimens, it is planned to build up a small subsidiary collection of seedlings, plants in their winter condition, and stump sprouts. Therefore it is desirable that such material be collected whenever it is probable that a later visit can be made to the same locality and complete specimens be obtained from the same species and if possible from the same individual. Such collections in order to properly identify species important in successional changes on such areas are especially important from newly burned-over areas.

#### (b) Collection and Preparation of Specimens

The actual work of collection and preparation of the specimens is usually done by the assistant or divided between both members of the party but final responsibility for the quantity and quality of the plant collections rests upon the party leader. It is also his duty to instruct his assistant in the proper technique of this phase of the work.

A record will be kept at the herbarium of the number and the quality of specimens submitted by each party. This record will be made a part of the work report of each field crew, so that the quantity and quality of botanical material collected will be one of the factors upon which the relative efficiency of each party will be judged.

While in general specimens must be gathered where found, it is often possible to secure specimens of several species in one locality. If the collector avails himself of such opportunities much time and labor may be saved. Here it is not necessary to open up and close the press for every specimen. The compilation of the data required on the field label is also much simplified. It is desirable to gather specimens from sample plots when practicable. This increases the amount of information available as to the ecology of the plant for there is then available not only the required information contained in the field notes themselves, but also the additional data compiled on the sample plot form. When this is done the number of the plot should be recorded under the heading "remarks" in the field notes.

Specimens should always be collected in duplicate. This is a minimum which should not be applied to annuals or grasses where several or even many plants are often needed to form a satisfactory specimen. With the exception of common and widely distributed species where the specimen will obviously have value only a record, it is advisable, even in the case of shrubs and trees to collect in triplicate. The specimens should not be scrappy. They should be of a size to approximately fill a herbarium sheet, but their length should not exceed approximately 15 inches. In cases, especially of annuals or grasses, where a specimen exceeds this length, it may be bent in a V, N, or M shape to bring the total length within the limits of the herbarium sheet.

It is well, however, to include one or two small scraps with each specimen, to be used for study.

If possible complete specimens (duplicate and triplicate) should be from a single plant. When this is impossible, as in the case of annuals, the specimen should at least be selected with some care to insure that all individuals are of the same species and from the immediate locality. All specimens should include as many as possible of the essential characters of the plant in their typical form. The ideal specimen should theoretically include every part of the plant, together with both flowers and fruit. It is realized, however, that it is often or perhaps usually impossible to secure such perfect specimens, yet some effort is warranted to approach the ideal as nearly as possible. It costs as much to prepare, annotate properly, and mount a poor specimen as it does a good one, yet the final value is likely to be very much less. Considering that the cost of a mounted specimen with its attendant records is more than 50 cents, it is obvious that a reasonable amount of care and effort in its selection and preparation is justified. If variations in size and shape of leaves occur, specimens should show such variations. In the case of some plants, the root or at least part of it is necessary for identification. A satisfactory specimen should always include a part of the stem with leaves and either flowers or fruits. <sup>4</sup>oots or underground parts should be included with all specimens of herbaceous plants and all monocotyledonous plants except these of a few shrubby or arborescent species such as *Xerophyllum*, *Yucca* spp., etc. Leaves separated from the stem can never constitute a satisfactory specimen though individual leaves submitted along with a specimen may have great value to show variations in leaf shape and size.

When the specimen has been gathered it should be placed in the specimen sheet as soon as possible; always before wilting has commenced. At this time the specimen should be trimmed to conform with the size of the sheet and arranged on the sheet. Often projecting parts can be removed to decrease the thickness of the specimens, and to insure more rapid drying. Projecting parts should be trimmed at this time as it is very difficult to cut away spines or projecting branchlets after such parts have become hardened by drying. Care should be taken to avoid placing too much material in a single specimen sheet. Specimens should as a rule never overlap each other. Where too much material is placed in a single specimen sheet drying is likely to be retarded or take place unevenly so that the plants may be attacked by molds or become wrinkled. After specimens are once arranged in a specimen sheet they should not be disturbed until drying is completed. The specimen sheet and included specimens should be handled as a unit when changing the driers.

After the specimen has been collected it is well to change the driers daily for the first three or four days and then every alternate day until the plant is thoroughly dried. Frequent changing of the driers does not result in burdensome additional labor, since the total number of changes necessary is usually not much greater if made daily than if made at longer intervals. Much better specimens result if changes are made frequently.

After specimens have been pressed 4 or 5 days with daily changing of driers many of them will not require a drier between every two sheets. Much time and labor can be saved if such partially dried specimens are combined. A convenient way to accomplish this is to number each sheet with the collection number on the lower right hand corner on the outside.

It is then a simple matter to combine the duplicate with the original (labelled specimen) by placing the duplicate sheet with specimen inside the specimen sheet of the original. Subsequently the original and its duplicates are handled as a single unit.

As a rule the field crews must complete the preparation of the specimens. The herbarium cannot assume the task of supplying deficiencies in field notes not that of drying specimens shipped in a fresh or partially dried condition. Emergencies may occur which may make it necessary or highly desirable to send to Berkeley specimens which are not thoroughly dry. This should be done only when the emergency has been explained and permission to ship such material obtained. Partially dried specimens should not be tightly pressed together for shipment and every care should be taken that such material will not remain packed for a longer period than two or three days. This also implies that shipment must be so timed that it will not arrive in Berkeley on Saturday, Sunday, or a holiday. If these instructions are not strictly adhered to there will be grave danger that the specimen will be so badly damaged by mold and decay as to be useless as herbarium specimens and thus the expense and effort involved in their collection will be lost.

Some plants dry very slowly and others shed their leaves during drying. Examples of the former are species of Sedum and Cotyledon and, of course, the cacti. Examples of the latter are hemlock and some of the firs. If such plants are immersed in boiling water for about ten minutes subsequent drying will proceed more rapidly in the case of such plants as Sedum while most or all of the leaves should be retained by specimens of hemlock or fir. If any of the cacti are collected they should be sent to the herbarium in the fresh condition with complete field notes. Fleshy stems or bulbs may be split or sliced open to facilitate drying.

## (c) Instruction for Filling Out Forms

The proper recording of field notes forms an essential part of the preparation of a specimen. In this discussion each sub-heading of the form will be considered in turn.

1. Herbarium No. - This should not be applied in the field. It refers to the number permanently applied to the specimen in the herbarium.

2. Botanical Name - Record the scientific name used for field identification.

3. Common name - This should not be filled in unless the collector can contribute a common name used locally. It is important to secure local common names used by settlers, stockmen, etc., whenever possible. It is not intended that common names appearing in Jepson's Manual or those in official use by the Forest Service be inserted here. When a local common name is applied the source should be given under "remarks" e.g. "in general use by Mexicans", "used by stockmen", "used by children", etc.

4. Quadrangle - This is self-explanatory, except that the reference should be to a 15' or 30' quadrangle rather than to a smaller quadrangle within one of the others. For example: "Chico" rather than "Chico Landing".

5. No. - This heading has been sometimes misinterpreted to refer to the number applied to the quadrangle itself. The space following "No." should be used for the field number of the collector. The field number is important since it affords a permanent and simple means of referring to a specific specimen. Each man should have his own series of field numbers and these should be applied consecutively and in chronological sequence to specimens collected by him. Thus a higher field number can be applied logically only to a specimen collected on the same or later date than that of a specimen with a lower field number. For example, a collector cannot logically have a specimen with a field number 100 collected on March 8, and one with a field number 90 collected on March 9. Field numbers of a single collector are never duplicated by the collector but continue in indefinite sequence regardless of where or with whom he may be working. Field numbers for plant collections made by each member of the organization are now available. Each man should hold himself responsible for the correct application of field numbers. The herbarium cannot assume the responsibility of keeping track of all field number series.

When necessary to record a number instead of a name on a sample plot form because the species is not known the number should be the collector's number of the specimen, not an arbitrary number assigned to an unknown. If this number is not in the number series of the person taking the plot, then the initials of the individual whose field number it is, should be given. Thus if A and B are working together and the specimens collected are by B, then if A takes a sample plot and records a specimen numbered 346 in B's field number series it should be recorded B346 and not simply 346.

6. County - This is self-explanatory, but should always be filled in, especially in cases where the locality is near a county boundary.

7. Elevation - Record the elevation to the nearest figure allowed by the topographic map.

8. National Forest - The name should always be given. If not in a National Forest indicate by a dash.

9. Locality - The locality is important and should be one indicated on an available map of the region, preferably on the topographic map itself or on a National Forest map. If a name not recorded on the map is in general use it may be recorded under the heading "remarks" but the locality as given under this heading should always be a map locality. Directions should be indicated as N, NE, NNE, (16 points of the compass) rather than  $3\frac{1}{2}$  miles E,  $1\frac{1}{4}$  miles N. of such a reference point. If the plant is of such local occurrence that it requires a more definite localization it is worthy of a "remark". Reference to a sample plot alone is not sufficient for it is practically meaningless unless the sample plot sheet is at hand when the specimen is recorded in the herbarium. If collected on a sample plot, however, the fact should be noted since a study of the sample plot data may later afford valuable information as to the ecology of the specimen. Care should be taken to write the names of localities very legibly.

10. Sec. - T. - R. - Always record the township and range even in unsurveyed country. At least this much can be given and it narrows down the possible subsequent search for the locality from a whole quadrangle to an area of 36 square miles.

11. Collector - Record the name of the collector.
12. Date - Record the date on which the plant is collected.
13. Vegetation Type - In general record the subtype, by species, symbols, as indicated on the type map, but in areas of a different subtype too small to map, record subtype in which the specimen actually occurs. For example: the subtype as indicated on the type map may be WR, but springy meadows of 1-2 acres in size (too small to map) may occur. If the specimen is taken in one of these meadows, Md should be recorded as "Vegetation Type" on the herbarium sheet. Similarly, an S,Y subtype on the type map may enclose a few small areas of timberland chaparral 1-2 acres in size. If the specimen is taken in one of these timberland chaparral areas, Av Cc, (or the dominants for that chaparral subtype) should be shown under "Vegetation Type" on the herbarium sheet.
14. Slope - Record both exposure (as N, NW, W--8 points of the compass) and percent of slope (to nearest 5%).
15. Associate Species - Since the subtype has already been indicated it is not necessary to duplicate these species symbols. Record only the closest associated species in the same ecological habitat. Thus, in the first example under "Vegetation Type", W and R have no place here and should not be listed since W and R do not occur in the same ecological habitat as the plant from which the specimen was taken. Only the symbols for the species forming the meadow, i.e. Vec, Po, Sedges, and Lupines, if these occur, should be listed here. In the second case; similarly S and Y have no place here unless they actually occur in the timberland chaparral type. Also, Av, and Cc have already been listed and do not require repetition. In this case list Ci, Cf, Cpo (if these species occur) and other symbols for the species actually associated within the small timberland chaparral subtype; no others. Associated species should be recorded in the order of their approximate local abundance.

Every care should be taken that where symbols are used they are correct and that they are legibly written so that the possibility of error is reduced to a minimum.

16. Tree - Height - D.B.H. - Indicate that it is a tree by a check, its estimated height in feet, and its D.B.H. in inches.

17. Shrub - Height - Sprouting - Non-sprouting - Indicate by a check if the plant is a shrub, its height in feet in figures, and by a check whether it be sprouting or non-sprouting. This sprouting characteristic should be noted only as a result of direct observation upon the particular plant from which the specimens are obtained, or from observation of what is obviously and undoubtedly the same species growing in the immediate vicinity which have been exposed to the effects of fire. The individual plant should never be regarded as a sprouter simply because the species has been listed elsewhere as sprouting. Such generalizations should be reserved for the office. In case the characteristic is questionable, show the fact by entering a question mark. Since the importance and significance of stamp sprouting in the genus Arctostaphylos is very great, special care should be made to insure accurate records in regard to this characteristic when collecting specimens of any of the manzanitas.

18. Herb - Height - If the species is herb indicate by a check, giving the height in inches or feet,

19. Vine - If the plant is a vine it should be indicated by a check.

20. Remarks - Some subjects have already been indicated which may appropriately be included under this heading. In addition, include any other interesting facts regarding the plant, especially any information which may be obtained regarding its economic value, local uses, peculiarities in regard to its local distribution or occurrence, etc. Include here a note on the flower color since flowers often change color in drying. Do not forget to give the plot number if the specimen has been collected on a sample plot.

(d) Use of Symbols, Nomenclature, and Procedure for Securing New Symbols

There is appended a list of many of the plants which are likely to be encountered by the mapper. Each name is preceded by a symbol which will be used to indicate only that species upon the map or sample plot sheet. For convenience this list has been divided into two parts, the first of which includes all plants except the grasses and the second, grasses only. In each list the names of species are arranged alphabetically according to the names used in Jepson's "Manual of the Flowering Plants of California". Since this Manual has been adopted for use by the field staff it has been deemed preferable to adhere to the system of nomenclature used in it rather/<sup>than</sup> to attempt to conform strictly with Forest Service usage.

The list of plants appended contain the names and symbols for practically all the trees and shrubs of California listed in the Jepson's "Manual", together with a large percentage of the more widely distributed or important herbaceous plants and grasses. However, since it is impracticable to provide symbols for all plants which may be encountered by the mapper it will undoubtedly be necessary to amend or add to the list from time to time. Therefore when a species for which there appears to be no symbol provided occurs as a dominant on any area, specimens should be collected and sent to the herbarium with a letter explaining that a symbol for the species is desired. If practicable, a symbol will then be provided and the field parties who are likely to encounter the same species will be notified.

VIII. PHOTOGRAPHS1. PURPOSE

A photograph affords the most easily visualized illustration of any natural condition. A picture is also the most perfect and detailed record of any condition prevailing at the time of the exposure. Repetition at a later date will serve as easily visualized and detailed proof of subsequent vegetational changes.

The objective of this part of the project is to obtain a file of photographs to show:

1. Typical subtypes, species, timber stand conditions, etc.,
2. Variations or the range of conditions within the typical,
3. Interesting variations outside the range of the typical, and
4. Examples and results of the misuse of lands.

2. FIELD PROCEDURE(a) What the Picture Should Show

The picture should be selected to show definitely some particularly chosen condition. An endeavor to illustrate more than one major condition usually involves failure to bring out either one clearly.

In most cases closeups or interiors are better than distant pictures to illustrate shrub and woodland tree types. While these show understory conditions well in timber types, distant views are often necessary to properly illustrate general conditions of the stand. Closeups are required to show interesting points regarding individual species.

The subjects, which are classified below, will be vegetation types or plant associations, and individual species.

A. Plant Associations1. Natural

a. The Typical

Illustrate the association as it occurs on masses, showing the natural relationship of species, density of stand, and the relationship to slope, exposure, soil, etc.

b. The Atypical

Illustrate small types, or types containing species which have invaded other major associations as a result of climate, slope, exposure, etc.

3. Unnatural

I illustrate how economic or accidental, pursuits of man may have caused alterations in or rearrangement of associations through such agencies as cultivation, mining, logging, fire, or grazing. Show either the agency at work, or the new association with remaining pockets of the old.

## B. Individual Species

Illustrate typical specimens showing the details mainly necessary for identification.

### (b) Suggestions for Taking Good Pictures

In taking a good picture, lighting, composition or balance, and exposure are the main points for consideration.

The lighting plays a very important part. In general, do not take pictures at noon when the sun is directly overhead, or at other times when the sun is directly in back of or in front of the camera. This factor causes a lack of perspective or tonal contrast of the subject. Early morning (9:00 to 10:00) pictures, especially if taken of distant objects are usually better than those of the late afternoon due to the absence of haze.

In taking closeups of an individual bush, however, it is usually better that there be a haze or an overcast sky in order that there is not too much contrast between the light and dark portions of the subject.

The lighting also plays an important part in the composition of the picture. Shadows may conveniently break a foreground or a background which is too bright or monotonous.

The subject should be a trifle to one side of the center, and should be the principal point of interest. Do not let the background detract from the interest of the subject; rather, use it as a frame whenever possible, but remember that it is not good to completely frame a picture.

Try to avoid having two bright or two dark areas of equal size in one exposure, as this destroys balance. If the subject is light in color, endeavor to contrast it against a darker background, and vice versa.

In treating exposures, it is essential to stress the use of a tripod with a camera. It is best in most cases to stop the aperture to F-32 to get the sharpest picture. However, in closeups, if one single object is desired without much foreground or background, widen the aperture so that all other objects will be out of focus. In general, use the longest exposure that conditions will allow in order to get as much detail as possible in the shadowed portion of the subject.

It is important to remember the following points:

- 1.-The wider one sets the aperture, the less the depth of focus is obtained.
- 2.-The wider one sets the aperture, the less the time of exposure is required.
- 3.-The farther away the subject, the less the time of exposure is required.
- 4.-The darker the subject, the longer the time of exposure is required.
- 5.-Early morning and late afternoon light is usually weaker and a longer time of exposure is required.
- 6.-An overcast sky causes weaker light, and a longer time of exposure is required.

**(c) Instructions for Filling Out Form**

**Pack No:** Each individual shall number his first film pack #1 and proceed in chronological order from there on.

List here the film pack number.

**Exposure No:** List here the number of the exposure within the pack, this number will appear on the tab.

**Map Ref:** Record here the number used to locate and identify the picture on the supplementary map.

**County:** Record the county in which the exposure was made.

**Sec...T...R...:** Record here the location of the exposure with respect to public land boundaries.

**Location:** Record the geographic location as is done with sample plots and herbarium specimens.

**Description:** Fully describe the subject, and give all details which should be shown by the picture.

**Assoc. Species:** Record here all the species which are in the same ecological association as the subject. List them by species name in order of relative abundance, giving preference to tree species.

**Stop:** Record the width of aperture used for the exposure.

**Time:** Record the time of the exposure used for the picture.

**Author:** Record the name of the individual who made the exposure.

**(d) Instruction for Submitting Results**

Save the box and tinfoil in which the films were originally packed. When all the films of a pack or roll have been exposed, rewrap them in the original tinfoil and replace them in the box. Reinforce the outside of the box with stiff cardboard, and wrap securely with heavy paper. Then send the package by registered mail to the Berkeley office.

## IX. CREW ORGANIZATION AND RESPONSIBILITIES OF CREW LEADER

### 1.-CREW ORGANIZATION

A 2-man crew is ordinarily used, with one man designated as crew leader. The natural division of the work is for one man to map and the other to take sample plots, site index determinations, collect herbarium specimens, and all other jobs which the crew leader considers desirable. The assistant should keep fully occupied taking as many carefully chosen sample plots and site indexes as time permits.

Ordinarily the crew leader does the mapping, but an interchange of jobs, in his discretion, is desirable in order that both men become thoroughly familiar with all phases of the work.

In country where much of the area must be covered afoot, it is advantageous for both men to map, each taking a different route during the day. All of the area should be covered with as little duplication and waste effort as possible. In such cases both men will take sample plots, site index determinations, and other required data.

In country where it is necessary to use pack stock, it is usually best that one man do all mapping while the other moves camp, cares for the stock, does the cooking, etc.

### 2.-RESPONSIBILITIES OF CREW LEADER

#### (a) Planning of the Work

The crew leader will be held responsible for the efficient planning and conduction of all the work. He should see that needless travel is avoided and expenses kept to a minimum. The use of pack stock may be essential in areas inaccessible by automobile, but past experience has shown that saddle horses do not expedite the work sufficiently to justify their cost.

(b) Collection of Required Data

The crew leader shall be directly responsible to the project leader for the neatness, thoroughness of collection, and completeness of record of all required data. It is his duty to train the assistant in the proper and most efficient methods of collection of the data, and to see that they are perfectly understood, and carried out.

(c) Collection of Additional Data

In many areas, interesting additional data may be available. Data on locations and capacities of old lumber mills, and records of early cuttings, both of which lead to a knowledge of the early logging practices of a locality may be available. Occasionally old snapshots or photographs may be found which show that certain localities embraced entirely different vegetation types from those at present on the area. These, and many other interesting details which have a bearing upon vegetation either present or past should be investigated by the crew leader and discussed with either the field supervisor or project leader.

(d) Care of Data

An important responsibility of the crew leader is the proper safeguarding of all data from fire, theft, or other loss. A nearly completed map unit has a value ranging from \$500 to \$1,000 and should be guarded accordingly. No more original data should be retained in the field than is absolutely required for efficient conduct of the work. As soon as a map unit is complete, or no longer necessary in the field, it, together with overlays and all other data, should be securely sealed in envelopes reinforced by heavy paper tape to avoid danger of accidental opening during transit, and forwarded by registered mail to the Berkeley office.

When other agencies express their desire to use any of our actual field data, it is best to obtain official sanction directly from the project leader.

(e) Contacts with Interested People and Sources of Information

The crews should work in close cooperation with the Forest Supervisor and District and State Rangers. Their experience in and knowledge of the country, especially of road and trail locations, will help considerably in planning the work.

Local organizations as conservation societies, erosion and flood control departments, 4-H clubs, Y.M.C.A., etc., may be interested in the work. Contact with all of these is good advertisement for the type map and its uses. Opportunities of this nature should not be overlooked by the field men.

(f) Submission of Reports

An important duty of the crew leader is to keep in contact with his superiors at headquarters. All important difficulties of the work should be immediately discussed with them either by telegraph or telephone. Periodical reports should always be submitted promptly so that they will reach headquarters on or slightly before the dates due.

In submitting reports by filling in forms be sure that all data requested is recorded legibly. Written reports should be frankly and clearly stated. If possible, use a typewriter.

All reports, maps, and everything excepting that which is of a confidential nature should be addressed to Director, and labelled: Attention Mr. \_\_\_\_\_ (For whom intended). Confidential reports may be addressed directly to the party for whom they are intended.

(g) Care of Car and Other Equipment

In most country, the car is the most important equipment of the crew, and the efficiency of time spent by the crew depends directly upon its being kept in as perfect running condition as possible. Do not allow its minor ailments to remain unrepaired, for small jobs often become major ones. If a major repair job is necessary, wire headquarters, telling what the job is and what the charges will be, and await on an O.K. In general, treat the car just as if it were your own.

No equipment of any kind should be allowed to deteriorate. Clean and oil your increment borers at least once a day if they have been used, and in some cases where it is necessary to bore a lot of sugar pine, firs, or redwoods, they should be cleaned and oiled after each boring. Oil the diameter tape at frequent intervals to keep it free from rust. Keep the abney case in good condition to protect the instrument and insure against its loss. Don't use colored gasoline in gasoline stoves and lanterns as it plugs up the generators. Remember that the highest efficiency of the time spent depends directly upon the good condition of all equipment.

Responsibility for the condition of all equipment also rests upon the crew leader.

X. REPORTS

1. TYPE DESCRIPTIONS

On each published quadrangle there will appear concise descriptions of each type, designed to be helpful to those using the maps. With this in mind, upon completion of a quadrangle, the crew leader will submit a brief description of each type giving its main essential characteristic of the locality. The sample plots, the crew leader's notes and his observations while working the area should be the principal basis for this.

The data contained therein, for each type, should answer the following questions:

1. What is the average range in heights of the dominant species composing the type?
2. What is the range in D.B.H. of the dominant trees composing type?
3. What is the range in litter depth of the type?
4. What is the range in density of the type?
5. Do any of these factors have apparent correlation with soil, slope, exposure, elevation, etc?
6. Is type or any species in the type rare on quadrangle?
7. What are the characteristic understory species, and their importance?
8. What is the range of Site Index throughout type?
9. Are any species of the type endemic to the quadrangle or the area, or do they occur outside of reported range?
10. Are there any other interesting characteristics of type or subtypes?

If one crew works only a portion of a quadrangle, a type description should be submitted for that portion, in spite of the fact that another may be, or may have been written for the rest.

## 2.-MISCELLANEOUS INFORMATION

From time to time certain questions may develop in the field upon which the crew leader may need help in his judgment. He will report these in writing to the Berkeley office asking for either explanation or for field discussion.

Interesting areas or species deviations may be observed. Special reports of these by letter will be appreciated by the project leader.

Ideas concerning greater efficiency in any phase of the job should be reported to the project leader in memorandum form before any use is made of them.

Possibilities for new uses of the Vegetation Type map Data may be presented by field contacts with certain agencies. These should also be reported to the one in charge.

### 3.-MONTHLY PROGRESS

About the 20th of each month a map will be mailed to each crew leader. The area mapped during the month will be shown on this. A copy of the progress report form will be filled out and sent with the map to the Berkeley office to reach there not later than the 28th of the month.

### 4.-FIELD RESIDENCE

In addition to the mailing address which at all times should be on file at the Berkeley office, the crew leader will send in the address of his field residence. If he is camping out he will also send in detailed directions as to how his camp can be most easily reached by road or trail.

### 5.-FIELD DIARY

Each member of the field party must keep a field diary in which he will enter what has been accomplished for each day. The area worked, interesting happenings, special type variations, any questions which may have arisen that day, and anything deemed worth recording will appear here. This diary should be kept up to date. It should be available to the supervisor at any time he may request it.

X. APPENDIX1. SPECIES LIST WITH SYMBOLS(a) Grasses

| Symbol      | Name used in<br>Jepson's Manual | Changes in nomenclature in Hitchcock's "Manual of Grasses of the U.S." |
|-------------|---------------------------------|--|
| <u>A</u>    | Agrostis sp.                    |  |
| <u>AD</u>   | Andropogon sp.                  |  |
| <u>ADs</u>  | A. saccharoides                 |  |
| <u>Ae</u>   | Agrostis exarata                |  |
| <u>AG</u>   | Agropyron sp.                   |  |
| <u>AGc</u>  | A. canium                       | Agropyron subsecundum  |
| <u>AGpr</u> | A. pringlei                     |  |
| <u>AGs</u>  | A. spicatum                     |  |
| <u>AGsm</u> | A. smithii                      |  |
| <u>AGt</u>  | A. tenerum                      | A. pauciflorum   |
| <u>Ah</u>   | Agrostis hiemalis               |  |
| <u>Aha</u>  | A. hallii                       |  |
| <u>AI</u>   | Aira sp.                        | Deschampsia  |
| <u>Ai</u>   | Agrostis idahoensis             |  |
| <u>Aic</u>  | Aira caespitosa                 | D. caespitosa  |
| <u>AId</u>  | A. danthonioides                | D. danthonioides   |
| <u>AIf</u>  | A. holciformis                  | D. holciformis   |
| <u>AII</u>  | A. elongata                     | D. elongata  |
| <u>AL</u>   | Alopecurus sp.                  |  |
| <u>ALa</u>  | A. aequalis                     |  |
| <u>Ale</u>  | Agrostis lepida                 |  |
| <u>AMa</u>  | Ammophila arenaria              |  |
| <u>Ao</u>   | Agrostis oregonensis            |  |
| <u>AP</u>   | Aspris sp.                      | Aira   |

|             |                        |                              |
|-------------|------------------------|------------------------------|
| <u>Ap</u>   | Agrostis palustris     | Agrostis alba                |
| <u>APc</u>  | Aspris caryophyllea    | Aira caryophyllea            |
| <u>Ar</u>   | Agrostis rossae        |                              |
| <u>AS</u>   | Aristida sp.           |                              |
| <u>ASa</u>  | A. adscensionis        |                              |
| <u>ASd</u>  | A. divaricata          |                              |
| <u>ASf</u>  | A. fendleriana         |                              |
| <u>ASo</u>  | A. oligantha           |                              |
| <u>ASpu</u> | A. purpurea            |                              |
| <u>At</u>   | Agrostis thurberiana   |                              |
| <u>AV</u>   | Avena sp.              |                              |
| <u>AVb</u>  | A. barbata             |                              |
| <u>AVf</u>  | A. fatua               |                              |
| <u>AXo</u>  | Anthoxanthum odoratum  |                              |
| <u>Ba</u>   | Bromus arenarius       |                              |
| <u>Bb</u>   | B. brizaeformis        |                              |
| <u>Bc</u>   | B. carinatus           |                              |
| <u>Bco</u>  | B. commutatus          |                              |
| <u>BE</u>   | Beckmannia sp.         |                              |
| <u>BEe</u>  | B. erucaeformis        | Beckmannia syzigachne        |
| <u>Bg</u>   | Bromus grandis         |                              |
| <u>Bh</u>   | B. hordeaceus          | Bromus mollis                |
| <u>Bl</u>   | B. laevipes            |                              |
| <u>Bm</u>   | B. marginatus          | included in Bromus carinatus |
| <u>Bma</u>  | B. madritensis         |                              |
| <u>BO</u>   | Bouteloua sp.          |                              |
| <u>Bo</u>   | Bromus orcuttianus     |                              |
| <u>BOc</u>  | Bouteloua curtipendula |                              |
| <u>BOg</u>  | B. hirsuta             |                              |

|             |                      |                       |
|-------------|----------------------|-----------------------|
| <u>BOr</u>  | Bouteloua rothrockii |                       |
| <u>Br</u>   | Bromus rigidus       |                       |
| <u>Bra</u>  | B. racemosus         |                       |
| <u>BRm</u>  | Briza minor          |                       |
| <u>BRma</u> | B. maxima            |                       |
| <u>Bru</u>  | Bromus rubens        |                       |
| <u>Bse</u>  | B. secalinus         |                       |
| <u>Bsu</u>  | B. subvelutinus      | Bromus breviaristatus |
| <u>Bt</u>   | B. tectorum          |                       |
| <u>Btr</u>  | B. trinii            |                       |
| <u>Bu</u>   | B. unioloides        | B. catharticus        |
| <u>Bv</u>   | B. vulgaris          |                       |
| <u>Bx</u>   | B. sp.               |                       |
| <u>CA</u>   | Calamagrostis sp.    |                       |
| <u>CAb</u>  | C. breweri           |                       |
| <u>CAC</u>  | C. canadensis        |                       |
| <u>CAi</u>  | C. inexpansa         |                       |
| <u>CAn</u>  | C. nutkaensis        |                       |
| <u>CAP</u>  | C. purpurascens      |                       |
| <u>CAr</u>  | C. rubescens         |                       |
| <u>CEp</u>  | Cenchrus pauciflorus |                       |
| <u>CH</u>   | Chloris sp.          |                       |
| <u>CHv</u>  | C. virgata           |                       |
| <u>CI</u>   | Cinna sp.            |                       |
| <u>CIL</u>  | C. latifolia         |                       |
| <u>CT</u>   | Chaetochloa sp.      | Setaria               |
| <u>CTl</u>  | C. lutescens         | S. lutescens          |
| <u>CTv</u>  | C. viridis           | S. viridis            |
| <u>CY</u>   | Cynodon sp.          |                       |

|             |                       |                                 |
|-------------|-----------------------|---------------------------------|
| <u>CYd</u>  | Cynodon dactylon      |                                 |
| <u>D</u>    | Danthonia sp.         |                                 |
| <u>Da</u>   | D. americana          | Danthonia californica americana |
| <u>Dc</u>   | D. californica        |                                 |
| <u>DCg</u>  | Dactylis glomerata    |                                 |
| <u>DI</u>   | Distichlis sp.        |                                 |
| <u>Di</u>   | Danthonia intermedia  |                                 |
| <u>Dis</u>  | Distichlis spicata    |                                 |
| <u>DIt</u>  |                       | Distichlis stricta              |
| <u>Du</u>   | Danthonia unispicata  |                                 |
| <u>E</u>    | Elymus sp.            |                                 |
| <u>EC</u>   | Echinochlea sp.       |                                 |
| <u>Eca</u>  | Elymus canadensis     |                                 |
| <u>ECe</u>  | Echinochlea crusgalli |                                 |
| <u>Eco</u>  | Elymus condensatus    |                                 |
| <u>Eg</u>   | E. glaucus            |                                 |
| <u>Em</u>   | E. macounii           |                                 |
| <u>Emo</u>  | E. mollis             |                                 |
| <u>EPr</u>  | Epicampes rigens      | Muhlenbergia rigens             |
| <u>ER</u>   | Eragrostis sp.        |                                 |
| <u>ERc</u>  | E. cilianensis        |                                 |
| <u>ERca</u> | E. caroliniana        | Eragrostis pectinacea           |
| <u>Et</u>   | Elymus triticoides    |                                 |
| <u>F</u>    | Festuca sp.           |                                 |
| <u>Fb</u>   | F. bromoides          | Festuca dertonensis             |
| <u>Fc</u>   | F. confusa            |                                 |
| <u>Fca</u>  | F. californica        |                                 |
| <u>Fco</u>  | F. confinis           | F. kingii                       |
| <u>Fel</u>  | F. elatior            |                                 |
| <u>Fern</u> | F. elmeri             |                                 |

|             |                               |                     |
|-------------|-------------------------------|---------------------|
| <u>Fi</u>   | <i>Festuca idahoensis</i>     |                     |
| <u>Fm</u>   | <i>F. megalura</i>            |                     |
| <u>Fmv</u>  | <i>F. myuros</i>              |                     |
| <u>Fo</u>   | <i>F. occidentalis</i>        |                     |
| <u>Foc</u>  | <i>F. octoflora</i>           |                     |
| <u>Fp</u>   | <i>F. pacifica</i>            |                     |
| <u>Fr</u>   | <i>F. rubra</i>               |                     |
| <u>Fre</u>  | <i>F. reflexa</i>             |                     |
| <u>Fsb</u>  | <i>F. subulata</i>            |                     |
| <u>Fv</u>   | <i>F. viridula</i>            |                     |
| <u>GL</u>   | <i>Glyceria sp.</i>           |                     |
| <u>GLel</u> | <i>G. elata</i>               |                     |
| <u>GLp</u>  | <i>G. pauciflora</i>          |                     |
| <u>Gv</u>   | <i>Gastridium ventricosum</i> |                     |
| <u>H</u>    | <i>Hordeum sp.</i>            |                     |
| <u>Hg</u>   | <i>H. gussoneanum</i>         |                     |
| <u>HI</u>   | <i>Hilaria sp.</i>            |                     |
| <u>HIj</u>  | <i>H. jamesii</i>             |                     |
| <u>HIr</u>  | <i>H. rigida</i>              |                     |
| <u>Hj</u>   | <i>Hordeum jubatum</i>        |                     |
| <u>Hm</u>   | <i>H. murinum</i>             |                     |
| <u>HO</u>   | <i>Holcus sp.</i>             | <i>Sorghum</i>      |
| <u>HOh</u>  | <i>H. halepensis</i>          | <i>S. halepense</i> |
| <u>HY</u>   | <i>Hystrix sp.</i>            |                     |
| <u>HYc</u>  | <i>H. californica</i>         |                     |
| <u>K</u>    | <i>Koeleria sp.</i>           |                     |
| <u>Kc</u>   | <i>K. cristata</i>            |                     |
| <u>Kp</u>   | <i>K. phleoides</i>           |                     |
| <u>L</u>    | <i>Lolium sp.</i>             |                     |

|             |                          |                |
|-------------|--------------------------|----------------|
| <u>LAA</u>  | Lamarckia aurea          |                |
| <u>LEc</u>  | Lepturus cylindricus     |                |
| <u>Lm</u>   | Lolium multiflorum       |                |
| <u>LP</u>   | Leptochloa sp.           |                |
| <u>Lp</u>   | Lolium perenne           |                |
| <u>LPf</u>  | Leptochloa filiformis    |                |
| <u>Lt</u>   | Lolium temulentum        |                |
| <u>M</u>    | Melica sp.               |                |
| <u>Ma</u>   | M. aristata              |                |
| <u>Mb</u>   | M. bella                 | Melica bulbosa |
| <u>Mbu</u>  | M. bulbosa               | M. californica |
| <u>Mf</u>   | M. fugax                 |                |
| <u>Mfr</u>  | M. frutescens            |                |
| <u>Mg</u>   | M. geyeri                |                |
| <u>Mi</u>   | M. imperfecta            |                |
| <u>MOl</u>  | Monanthochloe littoralis |                |
| <u>Ms</u>   | Melica spectabilis       |                |
| <u>Msb</u>  | M. subulata              |                |
| <u>Mst</u>  | M. stricta               |                |
| <u>Mt</u>   | M. torreyana             |                |
| <u>MU</u>   | Muhlenbergia sp.         |                |
| <u>MUf</u>  | M. filiformis            |                |
| <u>MUj</u>  | M. jonesii               |                |
| <u>MUmo</u> | M. montana               |                |
| <u>MUp</u>  | M. porteri               |                |
| <u>MUr</u>  | M. repens                |                |
| <u>MUs</u>  | M. squarrosa             |                |
| <u>N</u>    | Notholcus sp.            | Holcus         |
| <u>Nl</u>   | N. lanatus               | H. lanatus     |

|             |                          |                |
|-------------|--------------------------|----------------|
| <u>O</u>    | Oryzopsis sp.            |                |
| <u>Oh</u>   | O. hymenoides            |                |
| <u>Ok</u>   | O. kingii                |                |
| <u>P</u>    | Poa sp.                  |                |
| <u>PA</u>   | Phalaris sp.             |                |
| <u>Pa</u>   | Poa annua                |                |
| <u>PAa</u>  | Phalaris angusta         |                |
| <u>PAc</u>  | P. californica           |                |
| <u>PAcn</u> | P. canariensis           |                |
| <u>PAm</u>  | P. minor                 |                |
| <u>PAp</u>  | P. paradoxa              |                |
| <u>PAr</u>  | P. arundinacea           |                |
| <u>Pbr</u>  | Poa brachyglossa         | Poa juncifolia |
| <u>Pbv</u>  | P. bigelovii             |                |
| <u>Pc</u>   | P. compressa             |                |
| <u>Pd</u>   | P. douglasii             |                |
| <u>Pf</u>   | P. fendleriana           |                |
| <u>Pg</u>   | P. gracillima            |                |
| <u>PH</u>   | Phleum sp.               |                |
| <u>PHa</u>  | P. alpinum               |                |
| <u>PHp</u>  | P. pratense              |                |
| <u>PL</u>   | Pleuropogon sp.          |                |
| <u>Pl</u>   | Poa longiligula          |                |
| <u>PLc</u>  | Pleuropogon californicus |                |
| <u>Ple</u>  | Poa leibergii            |                |
| <u>PLr</u>  | Pleuropogon refractus    |                |
| <u>PN</u>   | Panicum sp.              |                |
| <u>Pn</u>   | Poa nervosa              |                |
| <u>PNe</u>  | Panicum capiti capillare |                |

|             |                     |             |
|-------------|---------------------|-------------|
| <u>Pne</u>  | Poa nevadensis      |             |
| <u>POI</u>  | Pholiurus incurvus  |             |
| <u>Pp</u>   | Poa pratensis       |             |
| <u>Ppa</u>  | P. palustris        |             |
| <u>PRc</u>  | Phragmites communis |             |
| <u>PS</u>   | Paspalum sp.        |             |
| <u>Ps</u>   | Poa sandbergii      | Poa secunda |
| <u>Psc</u>  | P. scabrella        |             |
| <u>PSd</u>  | Paspalum distichum  |             |
| <u>PU</u>   | Puccinellia sp.     |             |
| <u>PUL</u>  | P. lemmoni          |             |
| <u>PUn</u>  | P. nuttalliana      |             |
| <u>PUnu</u> | P. nutkaensis       |             |
| <u>PUs</u>  | P. simplex          |             |
| <u>PY</u>   | Polypogon sp.       |             |
| <u>PYL</u>  | P. lutosus          |             |
| <u>PYm</u>  | P. monspeliensis    |             |
| <u>S</u>    | Stipa sp.           |             |
| <u>Sc</u>   | S. californica      |             |
| <u>Scm</u>  | S. comata           |             |
| <u>Sco</u>  | S. coronata         |             |
| <u>Se</u>   | S. elmeri           |             |
| <u>SI</u>   | Sitanion sp.        |             |
| <u>SIh</u>  | S. hanseni          |             |
| <u>SIhy</u> | S. hystrix          |             |
| <u>SIj</u>  | S. jubatum          |             |
| <u>Sle</u>  | Stipa lepida        |             |
| <u>Slt</u>  | S. lettermanni      |             |
| <u>SO</u>   | Sporobolus sp.      |             |

|             |                         |                         |
|-------------|-------------------------|-------------------------|
| <u>So</u>   | Stipa occidentalis      |                         |
| <u>SOa</u>  | Sporobolus asperifolius |                         |
| <u>SOai</u> | S. airoides             |                         |
| <u>Sp</u>   | Stipa pulchra           |                         |
| <u>SPf</u>  | Spartina foliosa        |                         |
| <u>Ss</u>   | Stipa speciosa          |                         |
| <u>St</u>   | S. thurberiana          |                         |
| <u>Sv</u>   | S. vaseyi               |                         |
| <u>SY</u>   | Syntherisma sp.         |                         |
| <u>SYs</u>  | S. sanguinalis          |                         |
| <u>T</u>    | Trisetum sp.            |                         |
| <u>Tca</u>  | T. canescens            |                         |
| <u>TOm</u>  | Torresia macrophylla    | Hierochloa occidentalis |
| <u>TRp</u>  | Triodia pulchella       |                         |
| <u>Ts</u>   | Trisetum spicatum       |                         |

(b) Plants Other Than Grasses

|     |                                       |
|-----|---------------------------------------|
| W   | <i>Abies concolor</i>                 |
| G   | <i>A. grandis</i>                     |
| R   | <i>A. magnifica</i>                   |
| S   | <i>A. magnifica shastensis</i>        |
| N   | <i>A. nobilis</i>                     |
| B   | <i>A. venusta</i>                     |
| Abc | <i>Abrotia alpina</i>                 |
| Abm | <i>A. maritima</i>                    |
| Abp | <i>A. pogonantha</i>                  |
| Abv | <i>A. villosa</i>                     |
| Agf | <i>Acaelia greggii</i>                |
| Acp | <i>Acaena pinnatifida californica</i> |
| Acs | <i>Acaenopappus sphaerocephalus</i>   |
| Aci | <i>Acer circinatum</i>                |
| Aeg | <i>A. glabrum</i>                     |
| M   | <i>A. macrophyllum</i>                |
| N   | <i>A. negundo californicum</i>        |
| Ami | <i>Achillea millefolium lamulosa</i>  |
| Aot | <i>Achlys triphylla</i>               |
| Aem | <i>Achyrochaena mollis</i>            |
| Aec | <i>Achyrocyphia cooperi</i>           |
| Ael | <i>Acleisanthes longifolia</i>        |
| Aea | <i>Actaea spicata arguta</i>          |
| Af  | <i>Adenostoma fasciculatum</i>        |
| As  | <i>A. sparsifolium</i>                |

|          |                                 |
|----------|---------------------------------|
| Zad      | <i>Adiantum</i> sp.             |
| Ado      | <i>Adelphia californica</i>     |
| <u>H</u> | <i>Aesculus californica</i>     |
| Agu      | <i>Agastache urticifolia</i>    |
| Agx      | <i>Agoseris</i> sp.             |
| Aga      | A. <i>apargioides</i>           |
| Aggr     | A. <i>grandiflora</i>           |
| Agh      | A. <i>heterophylla</i>          |
| Ahi      | A. <i>hirta</i>                 |
| Agg      | <i>Agrostemma githago</i>       |
| TH       | <i>Ailanthus glandulosa</i>     |
| Alo      | <i>Alhagi camelorum</i>         |
| Aio      | <i>Allenrolfia occidentalis</i> |
| Alx      | <i>Allium</i> sp.               |
| Alv      | A. <i>validum</i>               |
| Alix     | <i>Allocarya</i> sp.            |
| <u>A</u> | <i>Alnus rhombifolia</i>        |
| <u>R</u> | A. <i>rubra</i>                 |
| Ato      | A. <i>tanifolia</i>             |
| Avs      | A. <i>viridis sinuata</i>       |
| Amg      | <i>Ambrosia plicatistachya</i>  |
| Aa       | <i>Amelanchier alnifolia</i>    |
| Aca      | <i>Ancropa californica</i>      |
| Afr      | A. <i>fruticosa</i>             |
| Amsp     | <i>Amsinckia</i> sp.            |
| Ams      | A. <i>douglasiana</i>           |
| Ain      | A. <i>intermedia</i>            |

|      |                       |                                 |
|------|-----------------------|---------------------------------|
| Ana  | <i>Anagallis</i>      | <i>arvensis</i>                 |
| Anm  | <i>Anaphalis</i>      | <i>margaritacea</i>             |
| Anca | <i>Anemopsis</i>      | <i>californica</i>              |
| Anb  | <i>Angelica</i>       | <i>breweri</i>                  |
| Anl  | A.                    | <i>lineariloba</i>              |
| Ant  | A.                    | <i>tomentosa</i>                |
| Ano  | <i>Anisocoma</i>      | <i>acaulis</i>                  |
| Aal  | <i>Antennaria</i>     | <i>alpina</i>                   |
| And  | A.                    | <i>dioica</i>                   |
| Ano  | <i>Anthemis</i>       | <i>cotula</i>                   |
| Ang  | <i>Artichinum</i>     | <i>glandulosum</i>              |
| Ans  | A.                    | <i>speciosum</i>                |
| Apap | <i>Apeocynum</i>      | <i>androsacmifolium pumilum</i> |
| Apc  | A.                    | <i>cannabinum</i>               |
| Aqt  | <i>Aquilegia</i>      | <i>truncata</i>                 |
| Abl  | <i>Arabis</i>         | <i>blepharophylla</i>           |
| Abr  | A.                    | <i>breweri</i>                  |
| Ahf  | A.                    | <i>holboellii fendleri</i>      |
| Ahr  | A.                    | <i>holboellii retrofracta</i>   |
| Arl  | <i>Aralia</i>         | <i>californica</i>              |
| M    | <i>Arbutus</i>        | <i>menziesii</i>                |
| Arn  | <i>Artemesem</i>      | <i>merriamii</i>                |
| Aan  | <i>Aretostaphylos</i> | <i>andersonii</i>               |
| Aaa  | A.                    | <i>andersonii auriculata</i>    |
| Aap  | A.                    | <i>andersonii pehcoensis</i>    |
| Ab   | A.                    | <i>bicolor</i>                  |
| Aca  | A.                    | <i>canescens</i>                |
| Aco  | A.                    | <i>columbiana</i>               |
| Ado  | A.                    | <i>densifolia</i>               |

|     |                                |
|-----|--------------------------------|
| Ad  | <i>Arctostaphylos drupacea</i> |
| Ae  | <i>A. elegans</i>              |
| Agl | <i>A. glandulosa</i>           |
| Ag  | <i>A. glauca</i>               |
| Ah  | <i>A. hookeri</i>              |
| Ai  | <i>A. insularis</i>            |
| Al  | <i>A. luciaensis</i>           |
| Am  | <i>A. mansanita</i>            |
| Amn | <i>A. mariposa</i>             |
| Amb | <i>A. mariposa bivisum</i>     |
| Anr | <i>A. norensis</i>             |
| Any | <i>A. myrtifolia</i>           |
| An  | <i>A. nevadensis</i>           |
| Ani | <i>A. nisseniana</i>           |
| Anu | <i>A. nummularia</i>           |
| Aob | <i>A. obispoensis</i>          |
| Aot | <i>A. otagensis</i>            |
| Apy | <i>A. parryana</i>             |
| Aps | <i>A. pastillosa</i>           |
| Ap  | <i>A. patula</i>               |
| Ape | <i>A. pehuenensis</i>          |
| Api | <i>A. pilosula</i>             |
| Apm | <i>A. pumila</i>               |
| Apu | <i>A. pungens</i>              |
| Ar  | <i>A. radis</i>                |
| Ase | <i>A. sensitiva</i>            |
| Asi | <i>A. silvicola</i>            |
| Ast | <i>A. stanfordiana</i>         |

|      |                       |                              |
|------|-----------------------|------------------------------|
| At   | <i>Arctostaphylos</i> | <i>tomentosa</i>             |
| Au   | A.                    | <i>uva-ursi</i>              |
| Av   | A.                    | <i>viscida</i>               |
| Aw   | A.                    | <i>wieslanderi</i>           |
| Ay   | A.                    | <i>ynaeensis</i>             |
| Arx  | <i>Arenaria</i>       | sp.                          |
| Aco  | A.                    | <i>congesta</i>              |
| Ardo | A.                    | <i>douglasii</i>             |
| Arn  | A.                    | <i>nuttallii</i>             |
| Aic  | <i>Argemone</i>       | <i>intermedia corymbosa</i>  |
| Arp  | A.                    | <i>platyceras</i>            |
| Aph  | A.                    | <i>platyceras hispida</i>    |
| Area | <i>Aristolochia</i>   | <i>californica</i>           |
| Ard  | <i>Arnica</i>         | <i>discoides</i>             |
| Aar  | <i>Artemisia</i>      | <i>arbuscula</i>             |
| Ac   | A.                    | <i>californica</i>           |
| Are  | A.                    | <i>cana</i>                  |
| Adr  | A.                    | <i>dracunculoides</i>        |
| Aty  | A.                    | <i>pycnoccephala</i>         |
| Arr  | A.                    | <i>rothrockii</i>            |
| Arsp | A.                    | <i>spinescens</i>            |
| Atr  | A.                    | <i>tridentata</i>            |
| Ato  | A.                    | <i>tridentata nova</i>       |
| Apa  | A.                    | <i>tridentata parishii</i>   |
| Atf  | A.                    | <i>trifida</i>               |
| Avu  | A.                    | <i>vulgaris</i>              |
| Avh  | A.                    | <i>vulgaris heterophylla</i> |
| Asy  | <i>Arumous</i>        | <i>sylvester</i>             |

|      |                   |                        |
|------|-------------------|------------------------|
| Asco | <i>Acerum</i>     | <i>caudatum</i>        |
| Asco | <i>Asclepias</i>  | <i>californica</i>     |
| Asc  | A.                | <i>cordifolia</i>      |
| Aser | A.                | <i>eriocarpa</i>       |
| Asos | A.                | <i>erosa</i>           |
| Asf  | A.                | <i>fremontii</i>       |
| Asm  | A.                | <i>mexicana</i>        |
| Gas  | <i>Aspidium</i>   | sp.                    |
| Arn  | A.                | <i>rigidum argutum</i> |
| Asad | <i>Aster</i>      | <i>discondens</i>      |
| Asca | A.                | <i>canadensis</i>      |
| Asl  | A.                | <i>chilensis</i>       |
| Asco | A.                | <i>capitatus</i>       |
| Asm  | A.                | <i>missisii</i>        |
| Asr  | A.                | <i>radulinus</i>       |
| Ax   | <i>Astragalus</i> | sp.                    |
| Asbo | A.                | <i>belandieri</i>      |
| Ask  | A.                | <i>hookerianus</i>     |
| Aho  | A.                | <i>hornii</i>          |
| Aks  | A.                | <i>kernensis</i>       |
| Ale  | A.                | <i>lentiginosus</i>    |
| Alu  | A.                | <i>leucophyllus</i>    |
| Amu  | A.                | <i>missisii</i>        |
| Ano  | A.                | <i>notarvensis</i>     |
| Asn  | A.                | <i>nigrescens</i>      |
| Acc  | A.                | <i>oxyphyus</i>        |

|      |  |
|------|--|
| Aspu | <i>Astragalus purshii</i>                  |
| Astr | A. <i>trichopodus</i>                      |
| Affe | <i>Athyrium filix-foemina californicum</i> |
| Ata  | <i>Atriplex argentea</i>                   |
| Atk  | A. <i>bracteosa</i>                        |
| Atb  | A. <i>breweri</i>                          |
| Atc  | A. <i>canescens</i>                        |
| Aff  | A. <i>confertifolia</i>                    |
| Atex | A. <i>expansa</i>                          |
| Atha | A. <i>hastata</i>                          |
| Ath  | A. <i>hymenolytra</i>                      |
| Atl  | A. <i>lentiformis</i>                      |
| Atn  | A. <i>mittallii</i>                        |
| Apr  | A. <i>parryi</i>                           |
| Atpa | A. <i>patula</i>                           |
| Atp  | A. <i>polycarpa</i>                        |
| Ats  | A. <i>semibaccata</i>                      |
| Asp  | A. <i>spinifera</i>                        |
| Att  | A. <i>torreyi</i>                          |
| Aya  | <i>Ayenia californica</i>                  |
| Bd   | <i>Baccharis douglasii</i>                 |
| Be   | B. <i>emeryi</i>                           |
| Bag  | B. <i>glutinosa</i>                        |
| Bp   | B. <i>pilularis</i>                        |
| Bpl  | B. <i>plummerae</i>                        |
| Bsa  | B. <i>sarcocroides</i>                     |
| Bas  | B. <i>sergiloides</i>                      |
| Bv   | B. <i>viminea</i>                          |

|          |                               |
|----------|-------------------------------|
| Bax      | <i>Bacria</i> sp.             |
| Bac      | <i>B.</i> <i>chrysostema</i>  |
| Bap      | <i>B.</i> <i>platycarpa</i>   |
| Bho      | <i>Balsamorhiza hookeri</i>   |
| Be       | <i>B.</i> <i>sagittata</i>    |
| Bav      | <i>Barbarea vulgaris</i>      |
| Bj       | <i>Bebbia juncea</i>          |
| Bec      | <i>Beloperone californica</i> |
| Baq      | <i>Berberis aquifolium</i>    |
| Bef      | <i>B.</i> <i>californica</i>  |
| Bf       | <i>B.</i> <i>fremontii</i>    |
| Bn       | <i>B.</i> <i>nervosa</i>      |
| Ben      | <i>B.</i> <i>nevadensis</i>   |
| Bpi      | <i>B.</i> <i>pinnata</i>      |
| Bpu      | <i>B.</i> <i>pumila</i>       |
| Ber      | <i>B.</i> <i>repens</i>       |
| Bem      | <i>Bernardia myricifolia</i>  |
| <u>B</u> | <i>Betula fontinalis</i>      |
| Bgl      | <i>B.</i> <i>glandulosa</i>   |
| Bif      | <i>Bidens frondosa</i>        |
| Bil      | <i>B.</i> <i>levis</i>        |
| Bic      | <i>Biscutaria crecea</i>      |
| Brx      | <i>Brassica</i> sp.           |
| Bsd      | <i>B.</i> <i>adpressa</i>     |
| Bca      | <i>B.</i> <i>campestris</i>   |
| Bng      | <i>B.</i> <i>nigra</i>        |

|      |                                |                               |
|------|--------------------------------|-------------------------------|
| Baa  | <i>Briobellia strastylodes</i> | <i>arguta</i>                 |
| Bo   | <i>B.</i>                      | <i>californica</i>            |
| Bfr  | <i>B.</i>                      | <i>frutescens</i>             |
| Bg   | <i>B.</i>                      | <i>grandiflora</i>            |
| Bm   | <i>B.</i>                      | <i>microphylla</i>            |
| Bm1  | <i>B.</i>                      | <i>multiflora</i>             |
| Bne  | <i>B.</i>                      | <i>novinii</i>                |
| Bol  | <i>B.</i>                      | <i>oblongifolia linifolia</i> |
| Brc  | <i>Brodiaea</i>                | <i>capitata</i>               |
| Bco  | <i>B.</i>                      | <i>coronaria</i>              |
| Bhy  | <i>B.</i>                      | <i>hyacinthina</i>            |
| Bi   | <i>B.</i>                      | <i>ixioides</i>               |
| Bl   | <i>B.</i>                      | <i>laxa</i>                   |
| Brp  | <i>B.</i>                      | <i>pulchella</i>              |
| Bvo  | <i>B.</i>                      | <i>volubilis</i>              |
| Cac  | <i>Calandrinia</i>             | <i>canlescens</i>             |
| Glx  | <i>Calochortus</i>             | <i>sp.</i>                    |
| Calb | <i>C.</i>                      | <i>albus</i>                  |
| Caen | <i>C.</i>                      | <i>aeruleus</i>               |
| Cent | <i>C.</i>                      | <i>estivalis</i>              |
| Caco | <i>C.</i>                      | <i>concolor</i>               |
| Cke  | <i>C.</i>                      | <i>kennedyi</i>               |
| Call | <i>C.</i>                      | <i>leichtlinii</i>            |
| Calu | <i>C.</i>                      | <i>luteus</i>                 |
| Cam  | <i>C.</i>                      | <i>macrocarpus</i>            |
| Camo | <i>C.</i>                      | <i>monophyllus</i>            |

|      |                                 |
|------|---------------------------------|
| Gnu  | <i>Calochortus nudus</i>        |
| Cap  | <i>C. plummerae</i>             |
| Cpu  | <i>C. pulchellus</i>            |
| Clo  | <i>C. splendens</i>             |
| Cav  | <i>C. venustus</i>              |
| Cabi | <i>Caltha biflora</i>           |
| Clx  | <i>Calyceadenia</i> sp.         |
| Cno  | <i>C. mollis</i>                |
| Cln  | <i>C. multiglandulosa</i>       |
| Clp  | <i>C. oppositifolia</i>         |
| Cat  | <i>C. trumonta</i>              |
| Cao  | <i>Calycanthus occidentalis</i> |
| Gal  | <i>Calyptridium umbellatum</i>  |
| Cale | <i>Camassia leichtlinii</i>     |
| Caq  | <i>C. quamash</i>               |
| Cah  | <i>Canotia holacantha</i>       |
| Cab  | <i>Capsella bursa-pastoris</i>  |
| Cax  | <i>Carex</i> sp.                |
| Caba | <i>C. barbarae</i>              |
| Col  | <i>Carpenteria californica</i>  |
| Caga | <i>Cerum gairdneri</i>          |
| Caa  | <i>Cassia armata</i>            |
| Ctp  | <i>Cassiope mertensiana</i>     |
| Cch  | <i>Castanopsis chrysophylla</i> |
| Q    | <i>C. chrysophylla</i>          |
| Cem  | <i>C. chrysophylla minor</i>    |
| Ca   | <i>Castanopsis sempervirens</i> |
| Caf  | <i>Castilleja affinis</i>       |

|      |                                |
|------|--------------------------------|
| Cam  | <i>Castilleja angustifolia</i> |
| Cfi  | C. <i>foliolosa</i>            |
| Gala | C. <i>latifolia</i>            |
| Gemi | C. <i>miniata</i>              |
| Gpdo | C. <i>parviflora douglasii</i> |
| Gpi  | C. <i>pinetorum</i>            |
| Gsm  | <i>Caucalis microcarpa</i>     |
| Gx   | <i>Ceanothus</i> sp.           |
| Gar  | C. <i>arbores</i>              |
| Ga   | C. <i>austrosantensis</i>      |
| Gco  | C. <i>cordulatus</i>           |
| Ger  | C. <i>crassifolius</i>         |
| Ge   | C. <i>cuneatus</i>             |
| Goy  | C. <i>cyaneus</i>              |
| Gde  | C. <i>dentatus</i>             |
| Cin  | C. <i>dentatus impressus</i>   |
| Gd   | C. <i>divaricatus</i>          |
| Gdi  | C. <i>diversifolius</i>        |
| Gfe  | C. <i>ferrissae</i>            |
| Gfo  | C. <i>foliosus</i>             |
| Gg   | C. <i>greggii</i>              |
| Ggp  | C. <i>greggii perplexans</i>   |
| Cin  | C. <i>incanus</i>              |
| Gi   | C. <i>integerrimus</i>         |
| Gj   | C. <i>jepsenii</i>             |

|     |                           |                         |
|-----|---------------------------|-------------------------|
| Cjp | <i>Ceanothus jepsonii</i> | purpurea                |
| Cle | C.                        | laevis                  |
| Cm  | C.                        | macrocarpus             |
| Co  | C.                        | oliganthus              |
| Cpl | C.                        | papillosus              |
| Cpr | C.                        | parryi                  |
| Cpv | C.                        | parvifolius             |
| Cpi | C.                        | pinetorum               |
| Cpo | C.                        | prostratus              |
| Cpd | C.                        | prostratus divergens    |
| Cpg | C.                        | prostratus grandifolius |
| Cri | C.                        | rigidus                 |
| Crf | C.                        | rigidus fresnensis      |
| Csa | C.                        | sanguineus              |
| Cse | C.                        | serrulatus              |
| Cso | C.                        | sorediatus              |
| Csp | C.                        | spinosus                |
| Cp  | C.                        | spinosus palmeri        |
| Ct  | C.                        | thyrsiflorus            |
| Cto | C.                        | tomentosus              |
| Ctl | C.                        | tomentosus olivaceus    |
| Cv  | C.                        | velutinus               |
| Cvr | C.                        | velutinus laevigatus    |
| Cvl | C.                        | velutinus lorensenii    |
| Cve | C.                        | verrucosus              |
| Cvt | C.                        | vestitus                |

|      |   |
|------|---|
| Cmr  | <i>Celtis mississippiensis reticulata</i> |
| Cen  | <i>Centaurea melitensis</i>               |
| Cev  | <i>Centaureum venustum</i>                |
| Cdf  | <i>Centronia fitchii</i>                  |
| Cep  | <i>C. pungens</i>                         |
| Ceo  | <i>Cephalanthus occidentalis</i>          |
| Cen  | <i>Cerastium arvense</i>                  |
| Cvis | <i>C. viscosum</i>                        |
| Cdt  | <i>Cercidium torreyanum</i>               |
| Ceo  | <i>Cercis occidentalis</i>                |
| Cb   | <i>Cercocarpus betuloides</i>             |
| Cei  | <i>C. intricatus</i>                      |
| Cl   | <i>C. ledifolius</i>                      |
| Cmi  | <i>C. minutiflorus</i>                    |
| Cee  | <i>Cereus emoryi</i>                      |
| Ce   | <i>C. engelmannii</i>                     |
| CG   | <i>C. gigantea</i>                        |
| Cha  | <i>Chaenactis artemisiaefolia</i>         |
| Cho  | <i>C. cerphoelinia</i>                    |
| Chd  | <i>C. douglasii</i>                       |
| Chg  | <i>C. glabriscula</i>                     |
| Cne  | <i>C. nevadensis</i>                      |
| Chs  | <i>C. santolinoides</i>                   |
| Csu  | <i>C. suffrutescens</i>                   |
| Cca  | <i>C. xantiana</i>                        |

|      |                                   |
|------|-----------------------------------|
| Cf   | <i>Chamaebatia foliolosa</i>      |
| Cfa  | <i>C. foliolosa australis</i>     |
| Chm  | <i>Chamaebatiaria millefolium</i> |
| O    | <i>Chamaecyparis lawsoniana</i>   |
| Chum | <i>Chamaesaracha nana</i>         |
| Chx  | <i>Chenopodium sp.</i>            |
| Kea  | <i>C. album</i>                   |
| Kan  | <i>C. ambrosioides</i>            |
| Kca  | <i>C. californicum</i>            |
| Chl  | <i>Chilopsis linearis</i>         |
| Cum  | <i>Chimaphila umbellata</i>       |
| Chpo | <i>Chlorogalum penssylvanicum</i> |
| Cem  | <i>Cherisanthe membranacea</i>    |
| Ces  | <i>C. staticoides</i>             |
| Cbr  | <i>Chrysopsis breweri</i>         |
| Cvi  | <i>C. villosa</i>                 |
| Chr  | <i>Chrysothamnus sp.</i>          |
| Chb  | <i>C. bloomeri</i>                |
| Chn  | <i>C. nauseosus</i>               |
| Cnc  | <i>C. nauseosus occidentalis</i>  |
| Cns  | <i>C. nauseosus speciosus</i>     |
| Chp  | <i>C. parryi</i>                  |
| Chv  | <i>C. viscidiflorus</i>           |
| Cic  | <i>Cicuta californica</i>         |
| Cid  | <i>C. douglasii</i>               |
| Cix  | <i>Cirsium sp.</i>                |
| Cibr | <i>C. breweri</i>                 |
| Cicc | <i>C. occidentale coulteri</i>    |

|      |                                     |
|------|-------------------------------------|
| Cel  | <i>Clarkia elegans</i>              |
| Cla  | <i>Clematis lasiantha</i>           |
| Cli  | <i>C. ligusticifolia</i>            |
| Cpa  | <i>C. pauciflora</i>                |
| Cob  | <i>Cleomea obtusifolia</i>          |
| Cipl | <i>Cleome platycarpa</i>            |
| Cdu  | <i>Cnecridium discosum</i>          |
| Cnb  | <i>Cnicus benedictus</i>            |
| Cra  | <i>Coleogyne ramosissima</i>        |
| Col  | <i>Collinsia bicolor</i>            |
| Ctt  | <i>C. tinctoria</i>                 |
| Cgr  | <i>Collomia grandiflora</i>         |
| Ced  | <i>Comarostaphylis diversifolia</i> |
| Cly  | <i>Gondalia lycioides</i>           |
| Cpy  | <i>C. parryi</i>                    |
| Con  | <i>Conium maculatum</i>             |
| Coa  | <i>Convolvulus arvensis</i>         |
| Col  | <i>C. luteolus</i>                  |
| Coo  | <i>C. occidentalis</i>              |
| Cov  | <i>C. villosus</i>                  |
| Cop  | <i>Cordylanthus pilosus</i>         |
| Cosp | <i>Coreopsis sp.</i>                |
| Cbi  | <i>C. bigelovii</i>                 |
| Coca | <i>C. calliopsidea</i>              |
| Cog  | <i>C. gigantea</i>                  |
| Coc  | <i>Carethrogyne californica</i>     |
| Cef  | <i>C. filaginifolia</i>             |
| Cca  | <i>Cornus californica</i>           |
| Cgl  | <i>C. glabrata</i>                  |

|      |                                      |
|------|--------------------------------------|
| Cn   | <i>Cornus nuttallii</i>              |
| Cos  | <i>C. sessilis</i>                   |
| Cr   | <i>Corylus rostrata californica</i>  |
| Crt  | <i>C. rostrata tracyi</i>            |
| Cot  | <i>Cotula coronopifolia</i>          |
| Kof  | <i>Cotyledon farinosa</i>            |
| Kol  | <i>C. lanceolata</i>                 |
| Klx  | <i>C. laxa</i>                       |
| Kop  | <i>C. pulverulenta</i>               |
| Cst  | <i>Cowania mexicana stansburiana</i> |
| Cdo  | <i>Crataegus douglasii</i>           |
| H    | <i>C. douglasii</i>                  |
| Grb  | <i>Crossosoma bigelovii</i>          |
| Crea | <i>C. californicum</i>               |
| Cro  | <i>Croton californicus</i>           |
| Cri  | <i>Cryptantha intermedia</i>         |
| Cma  | <i>C. micrantha</i>                  |
| Qkf  | <i>Cucurbita foetidissima</i>        |
| Qkp  | <i>C. palmata</i>                    |
| TY   | <i>Cupressus forbesii</i>            |
| GY   | <i>C. goveniana</i>                  |
| HY   | <i>C. macnabiana</i>                 |
| BY   | <i>C. macnabiana bakeri</i>          |
| MY   | <i>C. macrocarpa</i>                 |
| KY   | <i>C. nevadensis</i>                 |
| PY   | <i>C. pygmaea</i>                    |
| SY   | <i>C. sargentii</i>                  |
| DY   | <i>C. sargentii duttoni</i>          |

|     |  |
|-----|--|
| Cy  | <i>Cycladenia humilis</i>                |
| CyG | <i>Gyneglossum grande</i>                |
| Cyo | <i>C. occidentale</i>                    |
| Cac | <i>Cytisus scoparius</i>                 |
| Dac | <i>Darlingtonia californica</i>          |
| Dag | <i>Datisca glomerata</i>                 |
| Dam | <i>Datura meteloides</i>                 |
| Dap | <i>Daucus pusillus</i>                   |
| Dha | <i>Delphinium californicum</i>           |
| Dhd | <i>D. decorum</i>                        |
| Dha | <i>D. hansenii</i>                       |
| Dhh | <i>D. hesperium</i>                      |
| Dhm | <i>D. nudicaule</i>                      |
| Dhp | <i>D. parryi</i>                         |
| Dht | <i>D. trolliifolium</i>                  |
| Dhv | <i>D. variegatum</i>                     |
| Dr  | <i>Dendroseris rigida</i>                |
| Dic | <i>Dentaria integrifolia californica</i> |
| De  | <i>Dicentra chrysantha</i>               |
| Dfo | <i>D. fernosa</i>                        |
| Da  | <i>Diplacus aurantiacus</i>              |
| Di  | <i>D. longiflorus</i>                    |
| Epu | <i>D. puniceus</i>                       |
| Dif | <i>Dipsacus fullonum</i>                 |

|     |                                  |
|-----|----------------------------------|
| Do  | <i>Dirca occidentalis</i>        |
| Dec | <i>Dodecatheon hendersonii</i>   |
| Drb | <i>Draba breweri</i>             |
| Dre | <i>D. cuneifolia</i>             |
| Dec | <i>D. corrugata</i>              |
| DrG | <i>D. glacialis</i>              |
| DrI | <i>D. lemmonii</i>               |
| Dye | <i>Dysodia cooperi</i>           |
| Ecy | <i>Echinocactus cylindraceus</i> |
| Ecp | <i>E. polycephalus</i>           |
| Efa | <i>Echinocystis fabacea</i>      |
| Ema | <i>E. macrocarpa</i>             |
| Eor | <i>E. oregana</i>                |
| Ech | <i>Ellisia chrysanthemifolia</i> |
| Eln | <i>E. membranacea</i>            |
| Emp | <i>Emmenanthe penduliflora</i>   |
| Emn | <i>Empetrum nigrum</i>           |
| Ea  | <i>Encelia acroni</i>            |
| Enc | <i>E. californica</i>            |
| Enf | <i>E. farinosa</i>               |
| Efr | <i>E. frutescens</i>             |
| Eoa | <i>Ephedra californica</i>       |
| Ene | <i>E. nevadensis</i>             |
| Epv | <i>E. viridis</i>                |
| Enn | <i>Epilobium angustifolium</i>   |

|      |                               |
|------|-------------------------------|
| Epb  | <i>Epilobium brevistylum</i>  |
| Epc  | E. <i>californicum</i>        |
| Epp  | E. <i>paniculatum</i>         |
| Erar | <i>Erechtites arguta</i>      |
| Erp  | E. <i>premarthoides</i>       |
| Ese  | <i>Eremocarpus setigerus</i>  |
| Ear  | <i>Ericameria arborescens</i> |
| Eb   | E. <i>brachylopis</i>         |
| Erc  | E. <i>cooperi</i>             |
| Eou  | E. <i>cuneata</i>             |
| Eos  | E. <i>cuneata spatulata</i>   |
| Es   | E. <i>ericoides</i>           |
| Eso  | E. <i>monactis</i>            |
| Epa  | E. <i>palmari</i>             |
| Epa  | E. <i>paniculata</i>          |
| Epr  | E. <i>parishii</i>            |
| Epi  | E. <i>pinifolia</i>           |
| Ert  | E. <i>teretifolia</i>         |
| Erea | <i>Erigeron canadensis</i>    |
| Erk  | E. <i>concinus</i>            |
| Erf  | E. <i>felicus</i>             |
| Egl  | E. <i>glaucus</i>             |
| Eia  | E. <i>incornatus</i>          |
| Eir  | E. <i>radicatus</i>           |
| Ers  | E. <i>salsuginosus</i>        |

|     |                                   |
|-----|-----------------------------------|
| Ec  | <i>Eriodictyon californicum</i>   |
| Ecr | E. <i>crassifolium</i>            |
| Eto | E. <i>tonnentorum</i>             |
| Et  | E. <i>trichocalyx</i>             |
| Etl | E. <i>trichocalyx lanatum</i>     |
| Erx | <i>Eriogonum</i> sp.              |
| Era | E. <i>arborescens</i>             |
| Eba | E. <i>baileyi</i>                 |
| Efc | E. <i>cinereum</i>                |
| Ed  | E. <i>deflexum</i>                |
| Eel | E. <i>elatum</i>                  |
| Ere | E. <i>elongatum</i>               |
| Ef  | E. <i>fasciculatum</i>            |
| Eff | E. <i>fasciculatum foliolosum</i> |
| Efp | E. <i>fasciculatum polifolium</i> |
| Egi | E. <i>giganteum</i>               |
| Eg  | E. <i>gracile</i>                 |
| Eho | E. <i>hoermannii</i>              |
| Ei  | E. <i>inflatum</i>                |
| Elo | E. <i>lobbii</i>                  |
| Era | E. <i>marifolium</i>              |
| Eai | E. <i>microthecium</i>            |
| Eav | E. <i>schavense</i>               |
| En  | E. <i>madum</i>                   |
| Eov | E. <i>ovalifolium</i>             |
| Ep  | E. <i>parvifolium</i>             |
| Eun | E. <i>umbellatum</i>              |
| Eru | E. <i>ursinum</i>                 |
| Eva | E. <i>virginicum</i>              |

|      |  |
|------|--|
| Ev   | <i>Eriogonum virgatum</i>                  |
| Ew   | <i>E. wrightii</i>                         |
| Eco  | <i>Eriophyllum confertiflorum</i>          |
| Elo  | <i>E. lanatum cuneatum</i>                 |
| Elg  | <i>E. lanatum grandiflorum</i>             |
| El   | <i>E. lanatum integrifolium</i>            |
| Es   | <i>E. staechadifolium</i>                  |
| Esa  | <i>E. staechadifolium artemisiaefolium</i> |
| Ero  | <i>Erodium botrys</i>                      |
| Eci  | <i>E. cicutarium</i>                       |
| Eca  | <i>E. moschatum</i>                        |
| Ery  | <i>Eryngium austrense</i>                  |
| Erj  | <i>E. jopsonii</i>                         |
| Erv  | <i>E. vaseyi</i>                           |
| Eas  | <i>Erysimum asperum</i>                    |
| Eryo | <i>E. capitatum</i>                        |
| Eac  | <i>Eschscholtzia californica</i>           |
| Eal  | <i>E. lobbia</i>                           |
| Eam  | <i>E. minutiflora</i>                      |
| Eu   | <i>Eucalyptus sp.</i>                      |
| Eur  | <i>Eucnide urens</i>                       |
| Euc  | <i>Eulobus californicus</i>                |
| Ec   | <i>Eucynus occidentalis</i>                |
| Usp  | <i>Euphorbia sp.</i>                       |
| Eua  | <i>E. albomarginata</i>                    |
| Eucr | <i>E. crenulata</i>                        |
| Ea   | <i>E. misera</i>                           |
| Eup  | <i>E. palmeri</i>                          |
| Eus  | <i>E. serpyllifolia</i>                    |

|      |                                  |
|------|----------------------------------|
| Bul  | <i>Eurotia lanata</i>            |
| Evsp | <i>Elyx sparsiflorus</i>         |
| Fac  | <i>Fagonia californica</i>       |
| Fap  | <i>Fallugia paradoxa</i>         |
| Fic  | <i>Filago californica</i>        |
| Fig  | <i>F. gallica</i>                |
| Fim  | <i>Forestiera neo-mexicana</i>   |
| Fs   | <i>Fouquieria splendens</i>      |
| Fca  | <i>Fragaria californica</i>      |
| Fro  | <i>F. chilensis</i>              |
| FG   | <i>Frankenia grandifolia</i>     |
| Fgo  | <i>F. grandifolia campestris</i> |
| Fpa  | <i>F. palmeri</i>                |
| Fra  | <i>Franseria acanthiocarpa</i>   |
| Fbi  | <i>F. bipinnatifida</i>          |
| Fch  | <i>F. chenopodiifolia</i>        |
| Fdu  | <i>F. dumosa</i>                 |
| Fa   | <i>Fraxinus anomala</i>          |
| F̄   | <i>F. anomala</i>                |
| Fd   | <i>F. dipetala</i>               |
| F̄   | <i>F. oregana</i>                |
| Fv   | <i>F. velutina</i>               |
| F̄   | <i>F. velutina</i>               |
| Fco  | <i>F. velutina coriacea</i>      |
| Fo   | <i>Fremontia californica</i>     |
| Fem  | <i>F. californica mexicana</i>   |
| Gal  | <i>Galium sp.</i>                |

|      |                                   |
|------|-----------------------------------|
| Gen  | <i>Galium andrewsii</i>           |
| Gaf  | <i>G. angustifolium</i>           |
| Gap  | <i>G. aparine</i>                 |
| Gat  | <i>G. tricornis</i>               |
| Ge   | <i>Garrya elliptica</i>           |
| Gfl  | <i>G. flavescens</i>              |
| Gfb  | <i>G. flavescens buxifolia</i>    |
| Gfv  | <i>G. flavescens venosa</i>       |
| Gf   | <i>G. fremontii</i>               |
| Gv   | <i>G. ventchii</i>                |
| Gh   | <i>Gaultheria humifusa</i>        |
| Ge   | <i>G. shallon</i>                 |
| Gd   | <i>Gayophytum diffusum</i>        |
| Geo  | <i>Gentiana calycosa</i>          |
| Geh  | <i>G. holopetala</i>              |
| Gen  | <i>G. newberryi</i>               |
| Gdi  | <i>Geranium dissectum</i>         |
| Gi   | <i>G. incisum</i>                 |
| Gea  | <i>Geum macrophyllum</i>          |
| Get  | <i>G. triflorum</i>               |
| Gap  | <i>Gilia sp.</i>                  |
| Ga   | <i>G. aggregata</i>               |
| Gca  | <i>G. capitata</i>                |
| Gcaa | <i>G. capitata achillaeefolia</i> |
| Gig  | <i>G. gilicoides</i>              |
| Gla  | <i>G. latifolia</i>               |
| Gil  | <i>G. leptalea</i>                |
| Gin  | <i>G. multicaulis</i>             |
| Gtr  | <i>G. tricolor</i>                |

|      |                                   |
|------|-----------------------------------|
| Gis  | <i>Githopsis specularioides</i>   |
| Gls  | <i>Glossopetalon spinosum</i>     |
| Gll  | <i>Glycyrrhiza lepidota</i>       |
| Gb   | <i>Gnaphalium beneolens</i>       |
| Gnc  | G. <i>chilense</i>                |
| Gdc  | G. <i>decurrens californicum</i>  |
| Gra  | G. <i>ramosissima</i>             |
| Gcam | <i>Gedelia amoena</i>             |
| Gcar | G. <i>arcuata</i>                 |
| Gbi  | G. <i>biloba</i>                  |
| Gobo | G. <i>bottae</i>                  |
| Godu | G. <i>dudleyana</i>               |
| Goqu | G. <i>quadrivulnera</i>           |
| Gvi  | G. <i>viminea</i>                 |
| Grs  | <i>Grayia spinosa</i>             |
| Gro  | <i>Grindelia camporum</i>         |
| Gou  | G. <i>cuneifolia</i>              |
| Gro  | G. <i>robusta</i>                 |
| Gru  | G. <i>rubricaulis</i>             |
| Guc  | <i>Gutierrezia californica</i>    |
| Gl   | G. <i>lucida</i>                  |
| Gsa  | G. <i>sarothrae</i>               |
| Gt   | <i>Gymnogramme triangularis</i>   |
| Hca  | <i>Haplopappus carthagenoides</i> |
| Hcx  | H. <i>cutinatus</i>               |
| Hra  | H. <i>racemosus</i>               |
| Hac  | <i>Hazardia cana</i>              |
| Hs   | H. <i>squarrosa</i>               |
| Haw  | H. <i>whitneyi</i>                |
| Hcb  |                                   |

|      |                                  |
|------|----------------------------------|
| Hob  | <i>Helonium bigelovii</i>        |
| Hho  | H. <i>hoopesii</i>               |
| Hpu  | H. <i>puberulum</i>              |
| Hsc  | <i>Helianthemum scoparium</i>    |
| Hsv  | H. <i>scoparium vulgare</i>      |
| Hsn  | <i>Helianthus annuus</i>         |
| Hec  | H. <i>californicus</i>           |
| Hgr  | H. <i>gracilentus</i>            |
| Hpe  | H. <i>petiolaris</i>             |
| Hlc  | <i>Heliotropium curassavicum</i> |
| Hr   | <i>Hemiscia sp.</i>              |
| Hecc | H. <i>congesta</i>               |
| Hec  | H. <i>corymbosa</i>              |
| Hfa  | H. <i>fasciculata</i>            |
| Hvg  | H. <i>virgata</i>                |
| Hvh  | H. <i>virgata heermansii</i>     |
| Hla  | <i>Hernandezia lanatum</i>       |
| Hg   | <i>Heterotheca grandiflora</i>   |
| Hde  | <i>Hibiscus demodatus</i>        |
| Hod  | <i>Hoffmannseggia densiflora</i> |
| Hop  | <i>Hofmeisteria plurisetia</i>   |
| Hoe  | <i>Holacantha emoryi</i>         |
| Hol  | <i>Hollisteria lanata</i>        |
| Hd   | <i>Holodiscus discolor</i>       |
| Hdd  | H. <i>discolor dumosus</i>       |
| Hnd  | <i>Hugelia densiflora</i>        |
| Hug  | H. <i>virgata</i>                |
| Hrv  | <i>Hulsea vestita</i>            |
| Hyo  | <i>Hydrophyllum occidentale</i>  |

|     |                                      |
|-----|--------------------------------------|
| Hym | <i>Hymenoclea monogyra</i>           |
| Hys | <i>H. saisola</i>                    |
| Hyf | <i>Hymenopappus filifolius</i>       |
| Hyc | <i>Hypericum concinnum</i>           |
| Hfs | <i>H. formosum seculeri</i>          |
| Hp  | <i>H. perforatum</i>                 |
| Hyg | <i>Hypochoeris glabra</i>            |
| Hyr | <i>H. radicata</i>                   |
| Hye | <i>Hyptis emoryi</i>                 |
| Ird | <i>Iris douglasiana</i>              |
| Ih  | <i>I. hartwegii</i>                  |
| Ilo | <i>I. longipetala</i>                |
| Ims | <i>I. macrosiphon</i>                |
| Imi | <i>I. missouriensis</i>              |
| Iv  | <i>Isoetes veneta acradenia</i>      |
| Iva | <i>I. veneta arguta</i>              |
| Ivv | <i>I. veneta vernonioides</i>        |
| Ia  | <i>Isomeris arborea</i>              |
| Iax | <i>Iva axillaris</i>                 |
| Jac | <i>Jonesia americana californica</i> |
| Wc  | <i>Juglans californica</i>           |
| Wh  | <i>J. hindsii</i>                    |
| Jx  | <i>Juncus sp.</i>                    |
| Jbu | <i>J. bufonius</i>                   |
| Jue | <i>J. effusus</i>                    |
| Jc  | <i>Juniperus californica</i>         |
| Ju  | <i>J. Californica utahensis</i>      |
| Ja  | <i>J. communis montana</i>           |
| Jo  | <i>J. occidentalis</i>               |
| Kp  | <i>Kalmia polifolia</i>              |

|      |                                     |
|------|-------------------------------------|
| Kal  | <i>Kalmia polifolia microphylla</i> |
| Kg   | <i>Kelloggia galioides</i>          |
| Ken  | <i>Kentrophyta montana</i>          |
| Koa  | <i>Kochia americana</i>             |
| Koo  | <i>K. americana californica</i>     |
| Kra  | <i>Krameria canescens</i>           |
| Lac  | <i>Lactuca scariola</i>             |
| Lt   | <i>Larrea tridentata glutinosa</i>  |
| Lac  | <i>Lathyrus californicus</i>        |
| Lgr  | <i>L. graminifolius</i>             |
| Lpo  | <i>L. polyphyllus</i>               |
| Lsp  | <i>L. splendens</i>                 |
| Lss  | <i>L. strictus</i>                  |
| Lav  | <i>L. vestitus</i>                  |
| Lea  | <i>Lavatera assurgentiflora</i>     |
| Lae  | <i>Layia elegans</i>                |
| Lafr | <i>L. fremontii</i>                 |
| Laq  | <i>L. glandulosa</i>                |
| Lap  | <i>L. platyglossa</i>               |
| Lg   | <i>Lesum glandulosum</i>            |
| Leh  | <i>Lepidium lasiocarpum</i>         |
| Ln   | <i>L. nitidum</i>                   |
| Leq  | <i>Lepidospartum squematum</i>      |
| Lef  | <i>Leptodactylon californicum</i>   |
| Lpn  | <i>L. nuttallii</i>                 |
| Lpu  | <i>L. pungens</i>                   |
| Les  | <i>Lessingia leptoclada</i>         |
| Led  | <i>Leucothoe davisiae</i>           |
| Leu  | <i>Lewisia nevadensis</i>           |

|      |  |
|------|--|
| Ler  | <i>Lewisia rediviva</i>                |
| I    | <i>Libocedrus decurrens</i>            |
| Lig  | <i>Ligusticum grayi</i>                |
| Lih  | <i>Lilium humboldtii</i>               |
| Lpa  | L. <i>perdalium</i>                    |
| Lip  | L. <i>parvum</i>                       |
| Lir  | L. <i>rubescens</i>                    |
| Lw   | L. <i>washingtonianum</i>              |
| Lma  | <i>Limonanthus alba</i>                |
| Lnd  | L. <i>douglasii</i>                    |
| Lnr  | L. <i>rosea</i>                        |
| Lix  | <i>Limonanthus sp.</i>                 |
| Lja  | L. <i>andromedifolius</i>              |
| Lau  | L. <i>aureus</i>                       |
| Llb  | L. <i>bicolor</i>                      |
| Lld  | L. <i>dichotomus</i>                   |
| Lif  | L. <i>filipes</i>                      |
| Lini | L. <i>liniflorus</i>                   |
| Lin  | L. <i>montanus</i>                     |
| Lba  | <i>Liriodendron boreale americanum</i> |
| Lle  | <i>Liriodendron lewisii</i>            |
| Ld   | <i>Lithocarpus densiflora</i>          |
| T    | L. <i>densiflora</i>                   |
| Lde  | L. <i>densiflora echinoides</i>        |
| Laf  | <i>Lithophragma affinis</i>            |
| Lex  | <i>Lomatium sp.</i>                    |
| Lenc | L. <i>caruifolium</i>                  |

|     |                                 |
|-----|---------------------------------|
| Lcm | <i>Lesatium dasycarpum</i>      |
| Lcn | L. <i>nevadense</i>             |
| Lcm | L. <i>nudicaule</i>             |
| Lcp | L. <i>piperi</i>                |
| Lct | L. <i>utriculatum</i>           |
| Lco | <i>Lemnicera conjugalis</i>     |
| Lhc | L. <i>hispidula californica</i> |
| Li  | L. <i>interrupta</i>            |
| Lln | L. <i>involutata</i>            |
| Lil | L. <i>involutata ledebourii</i> |
| Lsu | L. <i>subspicata</i>            |
| Lou | L. <i>utahensis</i>             |
| Lx  | <i>Lotus</i> sp.                |
| Lam | L. <i>americana</i>             |
| Lca | L. <i>argophyllum</i>           |
| Lcr | L. <i>crassifolius</i>          |
| Ldo | L. <i>douglasii</i>             |
| Ldn | L. <i>douglasii nevadensis</i>  |
| Lof | L. <i>formosissimus</i>         |
| Lcg | L. <i>grandiflorus</i>          |
| Lha | L. <i>hastistratus</i>          |
| Lol | L. <i>leucophyllum</i>          |
| Lcn | L. <i>migranthus</i>            |
| Lca | L. <i>salsuginosus</i>          |
| La  | L. <i>secparius</i>             |
| Loc | L. <i>stipularis</i>            |
| Lst | L. <i>strigosus</i>             |
| Lts | L. <i>subpinnatus</i>           |
| Lgx | <i>Lupinus</i> sp.              |

|      |         |                 |
|------|---------|-----------------|
| Lal  | Lupinus | albicaulis      |
| La   | L.      | albifrons       |
| Lar  | L.      | arboreus        |
| Lbi  | L.      | bicolor         |
| Lub  | L.      | breweri         |
| Laca | L.      | caudatus        |
| Lch  | L.      | chaniscois      |
| Lac  | L.      | coarctatus      |
| Lud  | L.      | densiflorus     |
| Lux  | L.      | excubitus       |
| Lfo  | L.      | formosus        |
| Lug  | L.      | grayi           |
| Lhi  | L.      | hirsutissimus   |
| Lla  | L.      | latifolius      |
| Lul  | L.      | lyallii         |
| Lum  | L.      | micranthus      |
| Lun  | L.      | nanus           |
| Lrv  | L.      | nanus vallicola |
| Luo  | L.      | odoratus        |
| Lust | L.      | stiversi        |
| Lus  | L.      | succulentus     |
| Lut  | L.      | torreyi         |
| Lrv  | L.      | varicolor       |
| Lan  | Lycium  | andersonii      |
| Lca  | L.      | californicum    |
| Lyc  | L.      | cooperi         |
| Lyf  | L.      | fremontii       |

|      |                                 |
|------|---------------------------------|
| Lp   | <i>Lycium pallidum</i>          |
| Lto  | L. <i>torreyi</i>               |
| Ltw  | L. <i>torreyi wrightii</i>      |
| Lys  | <i>Lygodesmia spinosa</i>       |
| I'   | <i>Lycnothamnus floribundus</i> |
| Mad  | <i>Macroneura discoides</i>     |
| Mag  | M. <i>greenei</i>               |
| Mas  | M. <i>suffruticosa</i>          |
| Max  | <i>Madia</i> sp.                |
| Med  | M. <i>dissitiflora</i>          |
| Mel  | M. <i>elegans</i>               |
| Mex  | M. <i>exigua</i>                |
| Mosa | M. <i>sativa</i>                |
| Mae  | <i>Malacothrix californica</i>  |
| Mea  | M. <i>saxatilis</i>             |
| Kpa  | <i>Malva parviflora</i>         |
| Mat  | <i>Manillaria tetrancistra</i>  |
| Mv   | <i>Marrubium vulgare</i>        |
| Mav  | <i>Marsilea vestita</i>         |
| Msu  | <i>Matricaria suaveolens</i>    |
| Meap | <i>Medicago apiculata</i>       |
| Mhi  | M. <i>hispida</i>               |
| Mal  | <i>Melilotus alba</i>           |
| Mli  | M. <i>indica</i>                |
| Mes  | <i>Menodora spinescens</i>      |
| Mea  | <i>Mentzelia albicaulis</i>     |
| Mdi  | M. <i>dispersa</i>              |
| Msl  | M. <i>laevicaulis</i>           |

|      |   |
|------|---|
| Meli | <i>Mertensia lindleyi</i>               |
| Mzm  | <i>M. micrantha</i>                     |
| Mof  | <i>Menziesia ferruginea</i>             |
| Mos  | <i>Mertensia ciliata stenotechoides</i> |
| Ma   | <i>Mesembryanthemum aequilaterale</i>   |
| Mear | <i>M. crystallinum</i>                  |
| Moh  | <i>Micromeria chamissonis</i>           |
| Mic  | <i>Micropus californicus</i>            |
| Mox  | <i>Microseris</i> sp.                   |
| Map  | <i>M. sphaenocarpha</i>                 |
| Mia  | <i>M. attenuata</i>                     |
| Mid  | <i>M. douglasii</i>                     |
| Mil  | <i>Miltitsia glandulifera</i>           |
| Mix  | <i>Mimulus</i> sp.                      |
| Mb   | <i>M. bicolor</i>                       |
| Mbo  | <i>M. bolanderi</i>                     |
| Mbr  | <i>M. brevipes</i>                      |
| Mif  | <i>M. floribundus</i>                   |
| Mig  | <i>M. guttatus</i>                      |
| Mik  | <i>M. kelloggii</i>                     |
| Mle  | <i>M. lewisii</i>                       |
| Mn   | <i>M. moschatus</i>                     |
| Mt   | <i>M. torreyi</i>                       |
| Mf   | <i>Mirabilis froebellii</i>             |
| Ml   | <i>M. laevis</i>                        |
| Mod  | <i>Monardella douglasii</i>             |
| Mol  | <i>M. lanosolata</i>                    |
| Mo   | <i>M. odoratissima</i>                  |
| Mov  | <i>M. villosa</i>                       |

|     |                               |
|-----|-------------------------------|
| Mog | <i>Monolopia gracilis</i>     |
| Mom | <i>M. major</i>               |
| Mpe | <i>Mertia perfoliata</i>      |
| Mo  | <i>Myrica californica</i>     |
| Mh  | <i>M. hartwegii</i>           |
| Nl  | <i>Nana lobbia</i>            |
| Np  | <i>N. parryi</i>              |
| Nax | <i>Navarretia sp.</i>         |
| Naa | <i>N. atractyloides</i>       |
| Nao | <i>N. octulaefolia</i>        |
| Naf | <i>N. filicaulis</i>          |
| Nai | <i>N. intertexta</i>          |
| Nap | <i>N. pubescens</i>           |
| Neh | <i>Nemophila heterophylla</i> |
| Nma | <i>N. maculata</i>            |
| Nem | <i>N. menziesii</i>           |
| Nep | <i>N. parviflora</i>          |
| Na  | <i>Nicotiana attenuata</i>    |
| Nbi | <i>N. bigelovii</i>           |
| Ng  | <i>N. glauca</i>              |
| Nit | <i>N. trigonophylla</i>       |
| Nio | <i>Nitrophila occidentale</i> |
| Npa | <i>Nolina parryi</i>          |
| Nyp | <i>Nymphaea polysepala</i>    |
| Oex | <i>Oenothera sp.</i>          |
| Oee | <i>O. exserta</i>             |

|     |  |
|-----|--|
| Oed | <i>Oenothera dentata</i>                 |
| Oeh | <i>O.</i> <i>hookeri</i>                 |
| Oeo | <i>O.</i> <i>ovata</i>                   |
| Oeo | <i>O.</i> <i>scapoides</i>               |
| Oes | <i>O.</i> <i>spiralis</i>                |
| Olt | <i>Olneya tesota</i>                     |
| Ox  | <i>Opuntia</i> sp.                       |
| Oac | <i>O.</i> <i>acanthocarpa</i>            |
| Oba | <i>O.</i> <i>basilaris</i>               |
| Ob  | <i>O.</i> <i>bigelovii</i>               |
| Ocl | <i>O.</i> <i>clavata</i>                 |
| Oe  | <i>O.</i> <i>echinocarpa</i>             |
| Oer | <i>O.</i> <i>erinacea</i>                |
| Oo  | <i>O.</i> <i>occidentalis</i>            |
| Ooc | <i>O.</i> <i>occidentalis covillei</i>   |
| Oel | <i>O.</i> <i>occidentalis littoralis</i> |
| Opa | <i>O.</i> <i>parryi</i>                  |
| Op  | <i>O.</i> <i>prolifera</i>               |
| Or  | <i>O.</i> <i>ramosissima</i>             |
| Opu | <i>O.</i> <i>ursina</i>                  |
| Ova | <i>O.</i> <i>vaseyi</i>                  |
| Orx | <i>Orthocarpus</i> sp.                   |
| Ora | <i>O.</i> <i>attenuatus</i>              |
| Ord | <i>O.</i> <i>densiflorus</i>             |
| Ore | <i>O.</i> <i>erianthes</i>               |
| Orl | <i>O.</i> <i>lithospermoides</i>         |

|      |  |
|------|--|
| Opi  | <i>Orthocarpus</i> <sup>F</sup> <i>pilosus</i> |
| Orp  | <i>O.</i> <i>purpurascens</i>                  |
| Oo   | <i>Osmorhiza</i> <i>oerisiformis</i>           |
| Ooa  | <i>Osmorrhiza</i> <i>nuda</i>                  |
| Ooe  | <i>O.</i> <i>occidentalis</i>                  |
| Oxo  | <i>Oxalis</i> <i>corniculata</i>               |
| Oxo  | <i>O.</i> <i>oregana</i>                       |
| Ooi  | <i>Oxyria</i> <i>digyna</i>                    |
| Pay  | <i>Pachytima</i> <i>myrsinites</i>             |
| Pbr  | <i>Paeonia</i> <i>brownii</i>                  |
| Pal  | <i>Palafoxia</i> <i>linearis</i>               |
| Pah  | <i>Papaver</i> <i>heterophyllum</i>            |
| Pan  | <i>Parkinsonia</i> <i>microphylla</i>          |
| Paf  | <i>Paronychia</i> <i>franciscana</i>           |
| Par  | <i>Parosela</i> <i>arborescens</i>             |
| Pca  | <i>P.</i> <i>californica</i>                   |
| Pae  | <i>P.</i> <i>emoryi</i>                        |
| Pafr | <i>P.</i> <i>fremontii</i>                     |
| Pac  | <i>P.</i> <i>mollis</i>                        |
| Pap  | <i>P.</i> <i>parryi</i>                        |
| Ppo  | <i>P.</i> <i>polyadenia</i>                    |
| Pas  | <i>P.</i> <i>spinosa</i>                       |
| Pca  | <i>Pedicularis</i> <i>attollens</i>            |
| Pde  | <i>P.</i> <i>densiflora</i>                    |
| Peg  | <i>P.</i> <i>greenlandica</i>                  |
| Pese | <i>P.</i> <i>semibarbata</i>                   |
| Epl  | <i>Pellaea</i> <i>sp.</i>                      |
| Po   | <i>P.</i> <i>ornithopus</i>                    |

|      |                     |                                     |
|------|---------------------|-------------------------------------|
| Pep  | <i>Peltiphyllum</i> | <i>peltatum</i>                     |
| Per  | <i>Pentstemon</i>   | <i>ranunculiformis</i>              |
| Px   | <i>Pentstemon</i>   | <i>sp.</i>                          |
| Pac  | P.                  | <i>acuminatus</i>                   |
| Pan  | P.                  | <i>antirrhinoides</i>               |
| Pb   | P.                  | <i>breviflorus</i>                  |
| Peb  | P.                  | <i>bridgesii</i>                    |
| Pec  | P.                  | <i>castranthifolius</i>             |
| Pee  | P.                  | <i>confertus</i>                    |
| Pee  | P.                  | <i>confertus caeruleo-purpureus</i> |
| Peg  | P.                  | <i>confertus geniculatus</i>        |
| Pem  | P.                  | <i>confertus modestus</i>           |
| Pep  | P.                  | <i>confertus procerus</i>           |
| Per  | P.                  | <i>confertus rigidus</i>            |
| Pe   | P.                  | <i>cordifolius</i>                  |
| Pey  | P.                  | <i>corymbosus</i>                   |
| Ped  | P.                  | <i>deustus</i>                      |
| Pef  | P.                  | <i>fruticiformis</i>                |
| Pgl  | P.                  | <i>glaber</i>                       |
| Pgr  | P.                  | <i>gracilentus</i>                  |
| Pn   | P.                  | <i>heterophyllum</i>                |
| Pja  | P.                  | <i>jaffreyanus</i>                  |
| Pela | P.                  | <i>labrosus</i>                     |
| Pla  | P.                  | <i>lactus</i>                       |
| Pol  | P.                  | <i>launcii</i>                      |
| Pn   | P.                  | <i>newberryi</i>                    |

|      |  |
|------|--|
| Pepa | <i>Pentstemon palmeri</i>                |
| Fpa  | <i>P. parishii</i>                       |
| Prt  | <i>P. rattanii</i>                       |
| Pro  | <i>P. rothrockii</i>                     |
| Ps   | <i>P. spectabilis</i>                    |
| Pte  | <i>P. ternatus</i>                       |
| Pre  | <i>Peraphyllum ramosissimum</i>          |
| Pem  | <i>Perezia microcephala</i>              |
| Pet  | <i>Petalonyx thurberi</i>                |
| Ptp  | <i>Petasites palmata</i>                 |
| Pes  | <i>Peucephyllum schottii</i>             |
| Phx  | <i>Phacelia</i> sp                       |
| Pba  | <i>P. brachyloba</i>                     |
| Phca | <i>P. californica</i>                    |
| Pdi  | <i>P. distans</i>                        |
| Phdo | <i>P. douglasii</i>                      |
| Pfi  | <i>P. fremontii</i>                      |
| Fhh  | <i>P. heterophylla</i>                   |
| Phi  | <i>P. hispida</i>                        |
| Phy  | <i>P. hydrophyllaides</i>                |
| Phl  | <i>P. linearis</i>                       |
| Pmi  | <i>P. minor</i>                          |
| Phr  | <i>P. ramosissima</i>                    |
| Ptn  | <i>P. tanacetifolia</i>                  |
| Pht  | <i>P. ciliata thermalis</i>              |
| Pl   | <i>Philadelphus lewisii californicus</i> |

|      |                                 |
|------|---------------------------------|
| Pdo  | <i>Fallex dolichantha</i>       |
| Fhd  | <i>P. douglasii</i>             |
| Fhg  | <i>P. gracilis</i>              |
| Fhs  | <i>P. speciosa</i>              |
| Pa   | <i>Photinia arbutifolia</i>     |
| Fhb  | <i>Phyllodoce breweri</i>       |
| Fhe  | <i>P. empetriformis</i>         |
| Phar | <i>Physalis crassifolia</i>     |
| Phc  | <i>Physocarpus capitatus</i>    |
| Ws   | <i>Picea breweriana</i>         |
| Es   | <i>P. engelmannii</i>           |
| S'   | <i>P. sitchensis</i>            |
| Fm   | <i>Pickeringia montana</i>      |
| WP   | <i>Pinus albicaulis</i>         |
| HP   | <i>P. aristata</i>              |
| FP   | <i>P. balfouriana</i>           |
| P    | <i>P. cembroides monophylla</i> |
| PP   | <i>P. cembroides parryana</i>   |
| Lc   | <i>P. contorta</i>              |
| LB   | <i>P. contorta bolanderi</i>    |
| L    | <i>P. contorta murrayana</i>    |
| GP   | <i>P. coulteri</i>              |
| LP   | <i>P. flexilis</i>              |
| S    | <i>P. lambertiana</i>           |
| W'   | <i>P. monticola</i>             |
| BP   | <i>P. muricata</i>              |

|           |                                    |
|-----------|------------------------------------|
| J         | <i>Pinus ponderosa</i>             |
| J         | <i>P. ponderosa jeffreyi</i>       |
| MP        | <i>P. radiata</i>                  |
| DP        | <i>P. sabiniana</i>                |
| TP        | <i>P. torreyana</i>                |
| K         | <i>P. tuberculata</i>              |
| Fai       | <i>Pirola asarifolia incarnata</i> |
| Fp        | <i>P. picta</i>                    |
| Flx       | <i>Flagebothrys</i> sp             |
| Flg       | <i>P. canescens</i>                |
| Fla       | <i>P. nothofulvus</i>              |
| Fle       | <i>Plantago erecta</i>             |
| Flm       | <i>P. major</i>                    |
| Fma       | <i>P. maritima</i>                 |
| $\bar{S}$ | <i>Platanus racemosa</i>           |
| Flc       | <i>Platystemon californicus</i>    |
| Pci       | <i>Plectritis ciliosa</i>          |
| Flma      | <i>P. macrocera</i>                |
| Flca      | <i>Pluchea camphorata</i>          |
| Pse       | <i>P. sericea</i>                  |
| Pod       | <i>Pogogyne douglasii</i>          |
| Pose      | <i>P. serpylloides</i>             |
| Poac      | <i>Polygala acanthoclada</i>       |
| Pec       | <i>P. cornuta</i>                  |
| Pola      | <i>Polygonum acre</i>              |
| Palp      | <i>P. alpinum</i>                  |
| Pbs       | <i>P. bistortoides</i>             |

|          |                                      |
|----------|--------------------------------------|
| Pda      | <i>Polygonum davisiae</i>            |
| Pop      | <i>P. paronychia</i>                 |
| Psh      | <i>P. shastense</i>                  |
| Zpp      | <i>Polypodium sp</i>                 |
| Pvk      | <i>P. vulgare kaulfussii</i>         |
| Zps      | <i>Polystichum sp</i>                |
| Poa      | <i>P. aculeatum</i>                  |
| Pom      | <i>P. mutinum</i>                    |
| <u>P</u> | <i>Populus fremontii</i>             |
| <u>A</u> | <i>P. tremuloides</i>                |
| Pot      | <i>P. tremuloides</i>                |
| <u>B</u> | <i>P. trichocarpa</i>                |
| Pog      | <i>Porophyllum gracile</i>           |
| Pox      | <i>Potentilla sp</i>                 |
| Pbi      | <i>P. biennis</i>                    |
| Pct      | <i>P. congesta tilingii</i>          |
| Pof      | <i>P. fruticosa</i>                  |
| Pogl     | <i>P. glandulosa</i>                 |
| Pgo      | <i>P. gordonii</i>                   |
| Pogr     | <i>P. gracilis</i>                   |
| Plb      | <i>P. lindleyi puberula</i>          |
| Pos      | <i>P. santolinoides</i>              |
| Prs      | <i>Primula suffrutescens</i>         |
| Pj       | <i>Prosopis juliflora glandulosa</i> |
| Prp      | <i>P. pubescens</i>                  |
| Pad      | <i>Prunus andersonii</i>             |
| Pd       | <i>P. demissa</i>                    |
| Pe       | <i>P. emarginata</i>                 |
| Pf       | <i>P. fasciculata</i>                |

|      |  |
|------|--|
| P fr | <i>Prunus fremontii</i>                      |
| Pi   | <i>P. ilicifolia</i>                         |
| Psu  | <i>P. subcordata</i>                         |
| Ps   | <i>Pseudotsuga macrocarpa</i>                |
| D    | <i>P. taxifolia</i>                          |
| Psco | <i>Psilostrophe cooperi</i>                  |
| Psc  | <i>Psoralea californica</i>                  |
| Psm  | <i>P. macrostachya</i>                       |
| Pso  | <i>P. orbicularis</i>                        |
| Psp  | <i>P. physodes</i>                           |
| Pbc  | <i>Ptelea baldwinii</i> <del>crenulata</del> |
| Zpt  | <i>Pteris</i> sp                             |
| Pta  | <i>P. aquilina lanuginosa</i>                |
| Pg   | <i>Purshia glandulosa</i>                    |
| Pt   | <i>P. tridentata</i>                         |
| Pyc  | <i>Pycnanthemum californicum</i>             |
| Pr   | <i>Pyrus rivularis</i>                       |
| QA   | <i>P. rivularis</i>                          |
| A    | <i>Quercus agrifolia</i>                     |
| Q    | <i>Q. chrysolepis</i>                        |
| Qs   | <i>Q. chrysolepis nana</i>                   |
| D'   | <i>Q. douglasii</i>                          |
| Qd   | <i>Q. dumosa</i>                             |
| QD   | <i>Q. dumosa</i>                             |
| QM   | <i>Q. dumosa macdonaldii</i>                 |
| Qdu  | <i>Q. durata</i>                             |

|      |                                    |
|------|------------------------------------|
| E    | <i>Quercus engelmannii</i>         |
| G    | Q. <i>garryana</i>                 |
| Qgb  | Q. <i>garryana breweri</i>         |
| Qgs  | Q. <i>garryana semota</i>          |
| Qk   | Q. <i>kelloggii</i>                |
| B    | Q. <i>kelloggii</i>                |
| V    | Q. <i>lobata</i>                   |
| M'   | Q. <i>morehus</i>                  |
| Qp   | Q. <i>palmeri</i>                  |
| Qs   | Q. <i>sadleriana</i>               |
| T'   | Q. <i>tomentella</i>               |
| Qv   | Q. <i>vaccinifolia</i>             |
| W    | Q. <i>wislizenii</i>               |
| Qw   | Q. <i>wislizenii frutescens</i>    |
| Rax  | <i>Ranunculus</i> sp               |
| Rai  | R. <i>alismifolius</i>             |
| Rac  | R. <i>californicus</i>             |
| Rcy  | R. <i>cymbalaria</i>               |
| Rgl  | R. <i>glaberrimus</i>              |
| Rale | R. <i>lemonii</i>                  |
| Rsa  | <i>Raphanus sativus</i>            |
| Rc   | <i>Rhamnus californica</i>         |
| Rcc  | R. <i>californica crassifolia</i>  |
| Rco  | R. <i>californica obtusissima</i>  |
| Rcd  | R. <i>californica occidentalis</i> |
| Rct  | R. <i>californica tomentella</i>   |
| Rcr  | R. <i>crocea</i>                   |

|     |                                    |
|-----|------------------------------------|
| Rci | <i>Rhamnus crocea ilicifolia</i>   |
| Rcs | <i>R. crocea insularis</i>         |
| Rpu | <i>R. purshiana</i>                |
| Rru | <i>R. rubra</i>                    |
| Rri | <i>Rhodiola rosea integrifolia</i> |
| Rhc | <i>Rhododendron californicum</i>   |
| Rho | <i>R. occidentalis</i>             |
| Rd  | <i>Rhus diversiloba</i>            |
| Ri  | <i>R. integrifolia</i>             |
| Rl  | <i>R. laurina</i>                  |
| Ro  | <i>R. ovata</i>                    |
| Rt  | <i>R. trilobata</i>                |
| Ris | <i>Ribes sp</i>                    |
| Ram | <i>R. amarum</i>                   |
| Ra  | <i>R. aureum</i>                   |
| Rag | <i>R. aureum gracillimum</i>       |
| Rbi | <i>R. binomatum</i>                |
| Rb  | <i>R. bracteosum</i>               |
| Rca | <i>R. californicum</i>             |
| Rh  | <i>R. californicum hesperium</i>   |
| Rce | <i>R. cereum</i>                   |
| Rdi | <i>R. divaricatum</i>              |
| Rin | <i>R. inerme</i>                   |
| Rlc | <i>R. lacustre</i>                 |
| Rla | <i>R. laxiflorum</i>               |
| Rll | <i>R. leptanthum lasianthum</i>    |
| Rlo | <i>R. lobbia</i>                   |

|     |                                   |
|-----|-----------------------------------|
| Rm  | <i>Ribes malvaceum</i>            |
| Rmi | R. <i>malvaceum indecorum</i>     |
| Rma | R. <i>marshallii</i>              |
| Rme | R. <i>mensiesii</i>               |
| Rmo | R. <i>montigenum</i>              |
| Rn  | R. <i>nevadense</i>               |
| Rq  | R. <i>quercetorum</i>             |
| Rr  | R. <i>roezlii</i>                 |
| Rrc | R. <i>roezlii eruentum</i>        |
| Rs  | R. <i>sanguineum</i>              |
| Rsd | R. <i>sanguineum deductum</i>     |
| Rsg | R. <i>sanguineum glutinosum</i>   |
| Rse | R. <i>sericeum</i>                |
| Rsp | R. <i>speciosum</i>               |
| Rve | R. <i>velutinum</i>               |
| Rvg | R. <i>velutinum glanduliferum</i> |
| Rvb | R. <i>viburnifolium</i>           |
| Rvc | R. <i>victoris</i>                |
| Rvi | R. <i>viscosissimum</i>           |
| Rvh | R. <i>viscosissimum hallii</i>    |
| Roc | <i>Ranneya coulteri</i>           |
| Rol | <i>Rosa californica</i>           |
| Rg  | R. <i>gymnocarpa</i>              |
| Rom | R. <i>mohavensis</i>              |
| Rok | R. <i>mitkana</i>                 |
| Rop | R. <i>pisocarpa</i>               |
| Rst | R. <i>spitamea</i>                |

|      |                                   |
|------|-----------------------------------|
| Rx   | <i>Rubus</i> sp                   |
| Ele  | R. <i>leucodermis</i>             |
| Rp   | R. <i>parviflorus</i>             |
| Rus  | R. <i>spectabilis</i>             |
| Rv   | R. <i>vitifolius</i>              |
| Ruc  | <i>Rudbeckia californica</i>      |
| Ruh  | R. <i>hirta</i>                   |
| Rua  | <i>Rumex acetosella</i>           |
| Rhy  | R. <i>hymenosepalus</i>           |
| Rusa | R. <i>salicifolius</i>            |
| Sam  | <i>Salazaria mexicana</i>         |
| Six  | <i>Salicornia</i> sp              |
| Saa  | S. <i>ambigua</i>                 |
| Sas  | S. <i>subterminalis</i>           |
| Sx   | <i>Salix</i> sp                   |
| Xar  | S. <i>argophylla</i>              |
| Xab  | S. <i>breweri</i>                 |
| Xcm  | S. <i>commutata</i>               |
| Xcr  | S. <i>cordata</i>                 |
| Xe   | S. <i>exigua</i>                  |
| Xga  | S. <i>geyeriana argentea</i>      |
| Xl   | S. <i>laevigata</i>               |
| XD   | S. <i>lasiandra</i>               |
| Xla  | S. <i>lasiolepis</i>              |
| Xle  | S. <i>lemonii</i>                 |
| Xmb  | S. <i>melanopsis bolanderiana</i> |
| XN   | S. <i>nigra vallicola</i>         |
| Xap  | S. <i>petrophila</i>              |

|     |                                  |
|-----|----------------------------------|
| Xpm | <i>Salix phyllifolia</i> monica  |
| Xpi | S. <i>piperi</i>                 |
| Xs  | S. <i>seculeriana</i>            |
| Xsh | S. <i>sessilifolia</i> hindsiana |
| Xso | S. <i>sitchensis</i> coulteri    |
| Skt | <i>Salsola kali tenuifolia</i>   |
| Se  | <i>Salvia apiana</i>             |
| Sed | S. <i>carduacea</i>              |
| Ser | S. <i>carnosa</i>                |
| Sek | S.. <i>carnosa compacta</i>      |
| Sol | S. <i>clevelandii</i>            |
| Soo | S. <i>columbariae</i>            |
| Se  | S. <i>eremostachya</i>           |
| Sfu | S. <i>funerea</i>                |
| Sl  | S. <i>leucophylla</i>            |
| Sm  | S. <i>mellifera</i>              |
| Sln | S. <i>mohavensis</i>             |
| Sp  | S. <i>palmeri</i>                |
| Sso | S. <i>southernensis</i>          |
| Ss  | S. <i>spathacea</i>              |
| Bg  | <i>Sambucus glauca</i>           |
| Sr  | S. <i>racemosa</i>               |
| Sre | S. <i>racemosa callicarpa</i>    |
| Sv  | S. <i>velutina</i>               |
| Sax | <i>Sanicula</i> sp               |
| Sbi | S. <i>bipinnatifida</i>          |
| Sme | S. <i>mensiesii</i>              |
| Sav | <i>Sarcobatus vermiculatus</i>   |

|      |                                      |
|------|--------------------------------------|
| Sat  | <i>Saxifraga tolmiei</i>             |
| Sei  | <i>Scirpus acutus</i>                |
| Scol | <i>S. olneyi</i>                     |
| Seb  | <i>Scolioopus bigelovii</i>          |
| See  | <i>Scrophularia californica</i>      |
| Sfh  | <i>Securingea fasciculata hallii</i> |
| Sepu | <i>Sedella pumilus</i>               |
| Sex  | <i>Sedum sp</i>                      |
| Seo  | <i>S. obtusatum</i>                  |
| Ser  | <i>S. radiatum</i>                   |
| Ses  | <i>S. spathulifolium</i>             |
| Sd   | <i>Senecio douglasii</i>             |
| Sle  | <i>S. lugens exaltatus</i>           |
| Sep  | <i>S. pauciflorus</i>                |
| St   | <i>S. triangularis</i>               |
| Svu  | <i>S. vulgaris</i>                   |
| BT   | <i>Sequoia gigantea</i>              |
| R    | <i>S. sempervirens</i>               |
| Sha  | <i>Shepherdia argentea</i>           |
| SH   | <i>S. argentea</i>                   |
| Sih  | <i>Sida hederacea</i>                |
| Sid  | <i>Sidalcea diploscypha</i>          |
| Sigl | <i>S. glaucescens</i>                |
| Sim  | <i>S. malvaeflora</i>                |
| Sdm  | <i>Silene douglasii monantha</i>     |
| Sic  | <i>S. californica</i>                |
| Sig  | <i>S. gallica</i>                    |
| Sil  | <i>S. lemmonii</i>                   |
| Sea  | <i>Simmondsia californica</i>        |
| Sia  | <i>Sisymbrium altissimum</i>         |

|      |                             |
|------|-----------------------------|
| Sii  | Sisymbrium incisum          |
| Sio  | S. officinale               |
| Sip  | S. <del>P</del> innatum     |
| Sib  | Sisyrinchium bellum         |
| Sms  | Smilacina sessilifolia      |
| Sox  | Solanum sp                  |
| Sn   | S. nigrum                   |
| Su   | S. umbelliferum             |
| Sxa  | S. <del>x</del> antii       |
| Sxg  | S. xantii glabrescens       |
| Soc  | Solidago californica        |
| Soy  | S. corymbosa                |
| Soo  | S. occidentalis             |
| Ssp  | S. spathulata               |
| Sol  | Sonchus oleraceus           |
| Sos  | Sorbus sitchensis           |
| Sc   | Sphacele calycina           |
| Spa  | Sphaeralcea ambigua         |
| Sda  | S. davidsonii               |
| Sf   | S. Fasciculata              |
| Srf  | S. fremontii                |
| Sro  | S. rotundifolia             |
| Spca | Sphenosciadium capitellatum |
| Spc  | Spiraea caespitosa          |
| Sde  | S. densiflora               |
| Sdu  | S. douglasii                |
| Sbu  | Stachys bullata             |

|     |                                       |
|-----|---------------------------------------|
| Ste | <i>Stachys californica</i>            |
| Stp | <i>Stanleya pinnata</i>               |
| Sb  | <i>Staphylea bolanderi</i>            |
| Sac | <i>Statice arctica californica</i>    |
| Stn | <i>Stellaria media</i>                |
| Stn | <i>Stellaria nitens</i>               |
| Sli | <i>Stenotopsis linearifolius</i>      |
| Sla | <i>Stephanomeria lactucina</i>        |
| Str | <i>Stephanomeria runcinata</i>        |
| Svg | <i>Stephanomeria virgata</i>          |
| Stl | <i>Stillingia linearifolia</i>        |
| Sti | <i>Streptanthus inflatus</i>          |
| Sto | <i>Streptanthus tortuosus</i>         |
| So  | <i>Styrax officinalis californica</i> |
| Sof | <i>Styrax officinalis fulvescens</i>  |
| Suc | <i>Suaeda californica</i>             |
| Sud | <i>Suaeda depressa erecta</i>         |
| Sum | <i>Suaeda moquini</i>                 |
| Sus | <i>Suaeda suffrutescens</i>           |
| Eni | <i>Swertia nitida</i>                 |
| Swr | <i>Swertia radiata</i>                |
| Syx | <i>Symphoricarpos sp</i>              |
| Sal | <i>Symphoricarpos albus</i>           |
| Syl | <i>Symphoricarpos longiflorus</i>     |
| Smo | <i>Symphoricarpos mellis</i>          |
| Sar | <i>Symphoricarpos rotundifolius</i>   |
| Tag | <i>Tamarix gallica</i>                |

|          |                                      |
|----------|--------------------------------------|
| Tac      | <i>Tanacetum camphoratum</i>         |
| Tav      | <i>Taraxacum vulgare</i>             |
| U        | <i>Taxus brevifolia</i>              |
| Ted      | <i>Tetradoccus dioicus</i>           |
| To       | <i>Tetradymia canescens</i>          |
| Tec      | <i>Tetradymia comosa</i>             |
| Teg      | <i>Tetradymia glabrata</i>           |
| Ts       | <i>Tetradymia spinosa</i>            |
| Tst      | <i>Tetradymia stenolepis</i>         |
| Thf      | <i>Thalictrum fendleri</i>           |
| Tpo      | <i>Thalictrum polycarpum</i>         |
| Thm      | <i>Thamnosma montana</i>             |
| Thfl     | <i>Thelypodium flavescens</i>        |
| Tgv      | <i>Thermopsis gracilis venosa</i>    |
| Tma      | <i>Thermopsis macrophylla</i>        |
| <u>C</u> | <i>Thuja plicata</i>                 |
| Thx      | <i>Thysanocarpus sp</i>              |
| The      | <i>Thysanocarpus curvipes</i>        |
| Thl      | <i>Thysanocarpus laciniatus</i>      |
| Tio      | <i>Tidestromia oblongifolia</i>      |
| N        | <i>Torreya californica</i>           |
| Tte      | <i>Tribulus terrestris</i>           |
| Trw      | <i>Tricardia watsonii</i>            |
| Tx       | <i>Trichostema sp</i>                |
| Tl       | <i>Trichostema lanatum</i>           |
| Tld      | <i>Trichostema lanatum denudatum</i> |
| Tla      | <i>Trichostema lanceolatum</i>       |
| Tlx      | <i>Trichostema laxum</i>             |
| Te       | <i>Trientalis europaea latifolia</i> |

|                 |                            |
|-----------------|----------------------------|
| Trx             | Trifolium sp.              |
| Tra             | Trifolium albopurpureum    |
| Tram            | T. amplexans               |
| Tran            | Trifolium andersonii       |
| Trbe            | Trifolium beekwithii       |
| <del>Trct</del> | <del>T.</del>              |
| <del>Trde</del> | <del>T.</del>              |
| Trb             | Trifolium breweri          |
| Trci            | T. ciliatum                |
| Trde            | T. depauperatum            |
| Trf             | Trifolium fucatum          |
| Trg             | Trifolium gracilentum      |
| Tin             | Trifolium involueratum     |
| Trmc            | T. microcephalum           |
| Trni            | Trifolium microdon         |
| Trn             | Trifolium monanthum        |
| Treb            | Trifolium obtusiflorum     |
| Tro             | Trifolium olivaceum        |
| Tpr             | Trifolium pratense         |
| Tre             | Trifolium repens           |
| Trt             | Trifolium tridentatum      |
| Trv             | Trifolium variegatum       |
| Tov             | Trillium ovatum            |
| Tsg             | Trillium sessile giganteum |
| Tre             | Trixis californica         |
| Tgr             | Tropidocarpum gracile      |
| H               | Tsuga heterophylla         |
| HM              | Tsuga mertensiana          |
| Tya             | Typha angustifolia         |
| Tyl             | Typha latifolia            |
| Ue              | Ulex europaeus             |
| L'              | Umbellularia californica   |
| Uo              | Umbellularia californica   |

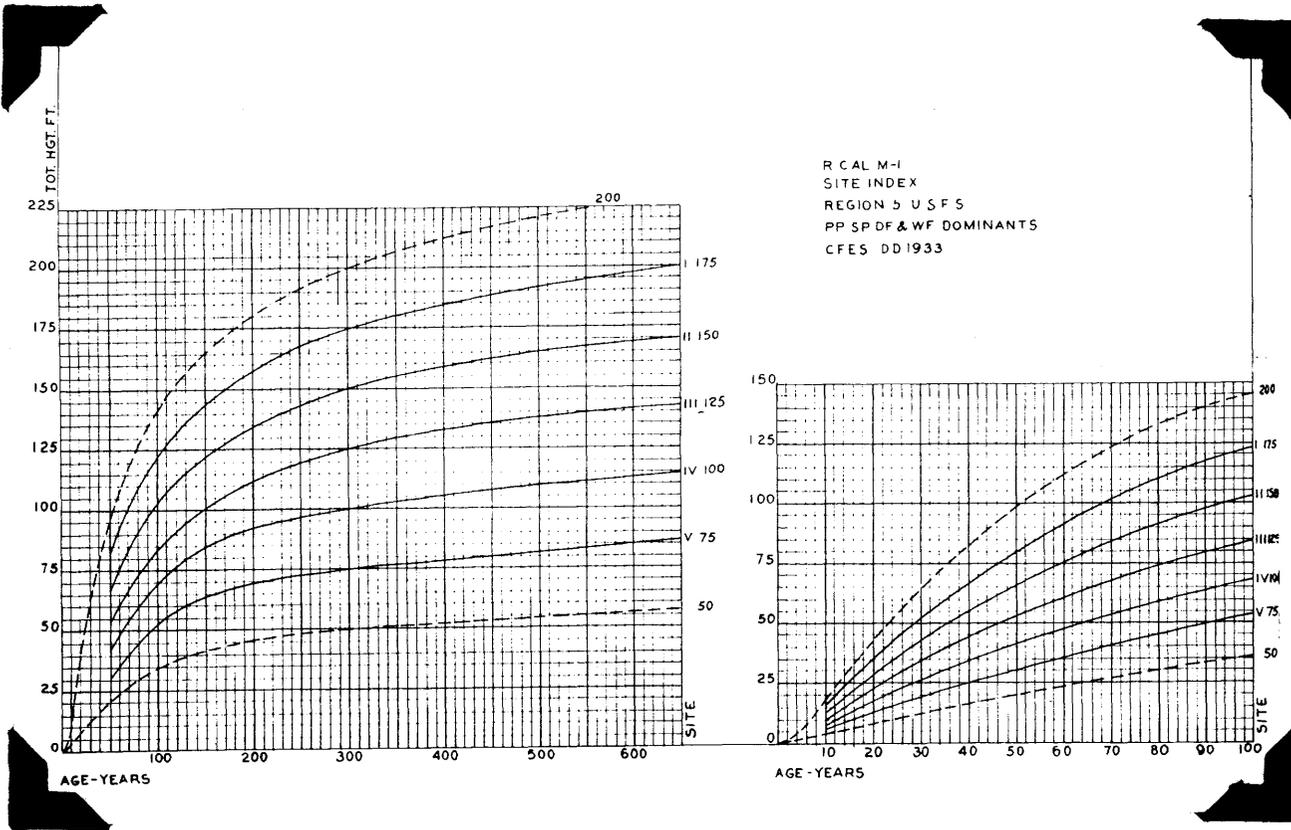
|     |                                    |
|-----|------------------------------------|
| Uli | <i>Uropappus linearifolius</i>     |
| Url | <i>Uropappus lindleyi</i>          |
| Ugh | <i>Urtica gracilis holosericea</i> |
| Vca | <i>Vaccinium caespitosum</i>       |
| Vm  | <i>Vaccinium membranaceum</i>      |
| Vmy | <i>Vaccinium myrtilus</i>          |
| Voc | <i>Vaccinium occidentale</i>       |
| Vo  | <i>Vaccinium ovatum</i>            |
| Vp  | <i>Vaccinium parvifolium</i>       |
| Vap | <i>Vancouveria parviflora</i>      |
| Vnc | <i>Venegasia carpesioides</i>      |
| Vec | <i>Veratrum californicum</i>       |
| Vev | <i>Veratrum viride</i>             |
| Vet | <i>Verbascum thapsus</i>           |
| Vel | <i>Viburnum ellipticum</i>         |
| Vam | <i>Vicia americana</i>             |
| Vgi | <i>Vicia gigantea</i>              |
| Vdp | <i>Viguiera deltoidea parishii</i> |
| Vl  | <i>Viguiera laciniata</i>          |
| Vir | <i>Viguiera reticulata</i>         |
| Vim | <i>Vinca major</i>                 |
| Va  | <i>Viola adunca</i>                |
| Vbe | <i>Viola beckwithii</i>            |
| Vib | <i>Viola blanda</i>                |
| Vic | <i>Viola cuneata</i>               |
| Vil | <i>Viola lobata</i>                |
| Vio | <i>Viola ocellata</i>              |

|      |                                |
|------|--------------------------------|
| Vpe  | <i>Viola pedunculata</i>       |
| Vipr | <i>Viola prunifera</i>         |
| Vip  | <i>Viola purpurea</i>          |
| Vls  | <i>Viola sarrantosa</i>        |
| Vc   | <i>Vitis californica</i>       |
| Vg   | <i>Vitis girdiana</i>          |
| F    | <i>Washingtoniana filifera</i> |
| Wm   | <i>Whipplea modesta</i>        |
| Wde  | <i>Whitneya dealbata</i>       |
| Woc  | <i>Woodsia scopulina</i>       |
| Zwo  | <i>Woodwardia</i> sp.          |
| Wor  | <i>Woodwardia radicans</i>     |
| Wya  | <i>Wyethia angustifolia</i>    |
| Wyg  | <i>Wyethia glabrata</i>        |
| Wh   | <i>Wyethia helenoides</i>      |
| Wm   | <i>Wyethia mollis</i>          |
| Wyo  | <i>Wyethia ovata</i>           |
| Xt   | <i>Xerophyllum tenax</i>       |
| Yx   | <i>Yucca</i> sp.               |
| YB   | <i>Yucca brevifolia</i>        |
| Yn   | <i>Yucca mohavensis</i>        |
| Yw   | <i>Yucca whipplei</i>          |
| Zc   | <i>Zauschneria californica</i> |
| Zac  | <i>Zauschneria cuneata</i>     |
| Zl   | <i>Zauschneria latifolia</i>   |

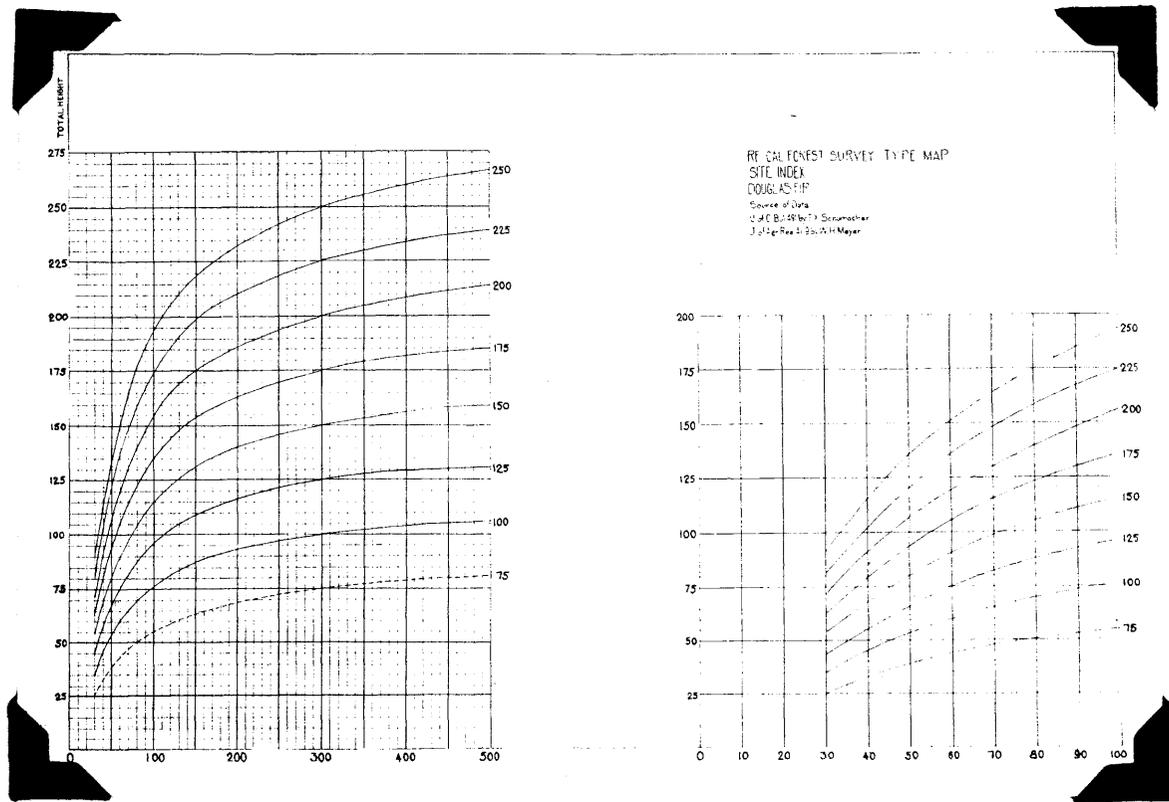
- Zf     *Zygadenus fremontii*  
Zpa    *Zygadenus paniculatus*  
Zve    *Zygadenus venenosus*

3. FORMS

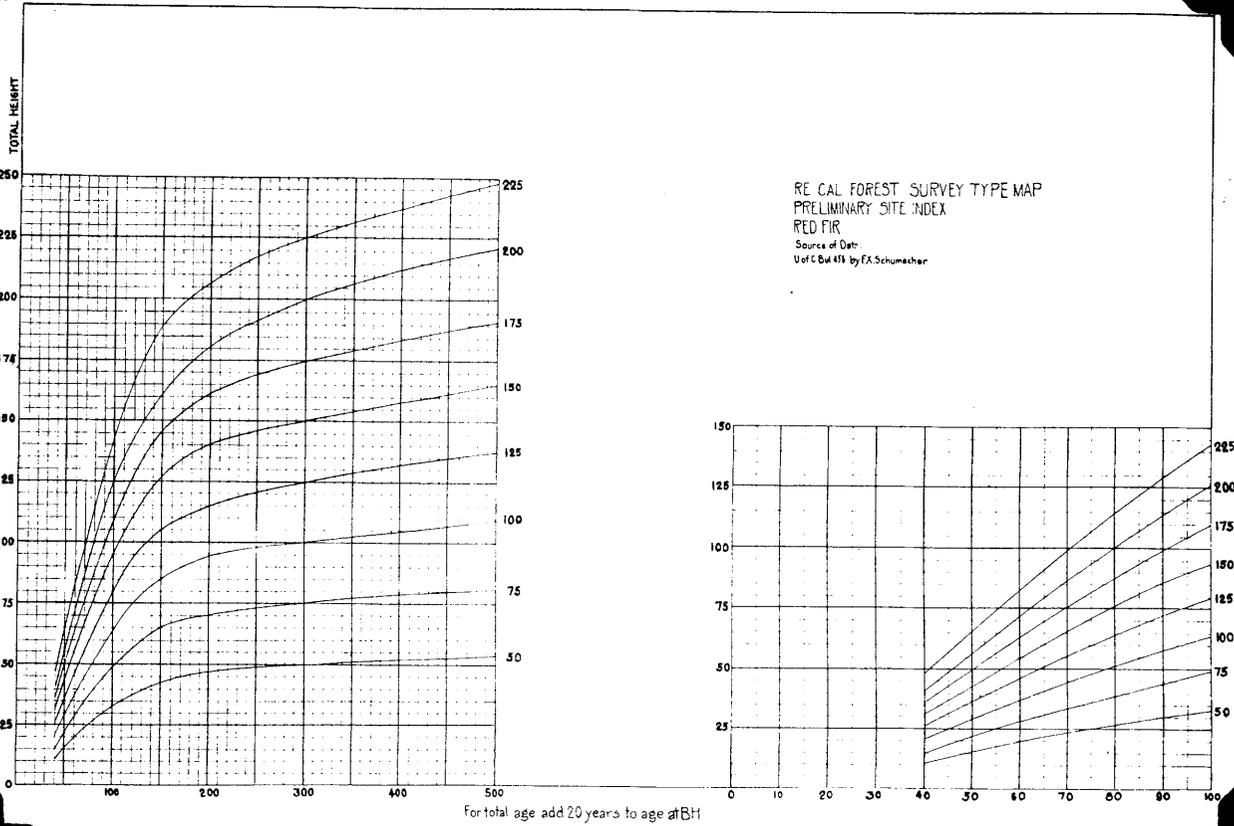
(a) Site Index Curves - Mixed Conifer



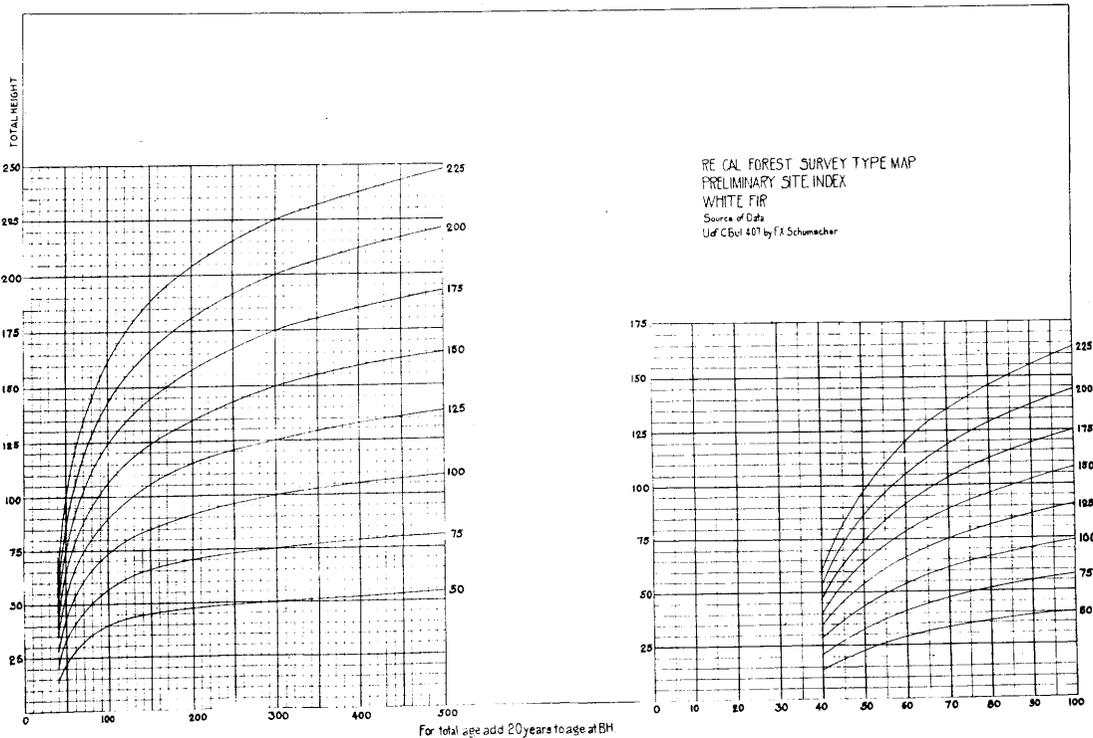
(b) Site Index Curves - Douglas Fir



(c) Site Index Curves - Red Fir



(d) Site Index Curves - White Fir





(f) Cutover Boundary Record

Quadrangle \_\_\_\_\_

County \_\_\_\_\_

Collected by \_\_\_\_\_

Ownership \_\_\_\_\_

Date Collected \_\_\_\_\_

Source of Data \_\_\_\_\_

Form 974.

T. \_\_\_\_\_ P. \_\_\_\_\_ Mes.

|    |    |    |    |    |    |
|----|----|----|----|----|----|
| 6  | 5  | 4  | 3  | 2  | 1  |
| 7  | 8  | 9  | 10 | 11 | 12 |
| 18 | 17 | 16 | 15 | 14 | 13 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 30 | 29 | 28 | 27 | 26 | 25 |
| 31 | 32 | 33 | 34 | 35 | 36 |

True Meridian.

8-257

SCALE.—One inch = 1 mile.

Legend of Dates of Cutting





(h) Herbaceous Sample Plot (Form C.F.E.S. #2)

Form CFES-1

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION  
 \*SAMPLE PLOT VEGETATIVE TYPE MAP

Plot No. .... Quadrangle.....

.....  
 Geographic Location (reference to mountain, stream, town, etc.)  
 .....

Elevation.....Sec.....T.....R.....

Taken by..... Date .....

|                             | Species                   | Shade | Open | Species | Shade | Open |
|-----------------------------|---------------------------|-------|------|---------|-------|------|
| Grasses Perennials          | <i>Noeleria cristata</i>  |       |      |         |       |      |
|                             | <i>Poa scabrella</i>      |       |      |         |       |      |
|                             | <i>Stipa pulchra</i>      |       |      |         |       |      |
| Grasses Annuals             | <i>Avena barbata</i>      |       |      |         |       |      |
|                             | <i>Avena fatua</i>        |       |      |         |       |      |
|                             | <i>Bromus arenarius</i>   |       |      |         |       |      |
|                             | <i>Bromus tectorum</i>    |       |      |         |       |      |
| Herbs or "Weeds"            | <i>Erodium moschatum</i>  |       |      |         |       |      |
|                             | <i>Erodium botrys</i>     |       |      |         |       |      |
|                             | <i>Erodium cicutarium</i> |       |      |         |       |      |
|                             | <i>Lotus</i>              |       |      |         |       |      |
|                             | <i>Medicago</i>           |       |      |         |       |      |
|                             | <i>Trifolium</i>          |       |      |         |       |      |
|                             | <i>Plagiobothrys</i>      |       |      |         |       |      |
|                             | <i>Eremocarpus</i>        |       |      |         |       |      |
|                             | <i>Hemizonia</i>          |       |      |         |       |      |
|                             | <i>Madia</i>              |       |      |         |       |      |
|                             | <i>Trichostema</i>        |       |      |         |       |      |
|                             | <i>Centaurea</i>          |       |      |         |       |      |
|                             | <i>Tribulus</i>           |       |      |         |       |      |
| <i>Hypericum perforatum</i> |                           |       |      |         |       |      |

\*5 Chain Strip





#### 4. GENERAL DESCRIPTIONS OF MAJOR GEOLOGIC ROCKS

IGNEOUS rocks are those which have formed directly from molten material termed the magma. If the magma is deep-seated, a plutonic rock is formed. If the magma is intruded just under the surface or if it is extruded, a volcanic rock is formed. Volcanics may be lavas or flow rocks, or they may be erupted from a volcano. They are distinguished by a fine-crystalline or stony groundmass. Plutonics may be distinguished by a coarse-crystalline or granitic texture.

SEDIMENTARY rocks are laid down by water or wind, or are the results of organic depositions. They are deposited as loose material like sand or clay. When these materials have been cemented into rock, they are termed respectively sandstone or shale. So long as the original material has not been altered by metamorphism, the rock is termed sedimentary.

METAMORPHIC rocks are either igneous or sedimentary rocks which have been altered by combined activities of heat, pressure, and chemical action.

No magma has been formed, but the component particles of the parent rock have become soft and plastic. Then, as the result of great pressure, they have been flattened, giving a striated appearance upon subsequent cooling. Since vertical expansion was impossible due to the downward pressure of the overlying rocks, the striations in the metamorphic rock become distorted and take on minor folds. The high temperatures cause the water and other substances in the rock to vaporize and become active agents in making chemical changes which form new minerals. Slates, schists, and gneisses represent successive degrees of metamorphism.

##### (a) Igneous Rocks

The identification of igneous rocks is based upon their mode of origin

and occurrence, chemical composition, and texture.

(1) Volcanics: Rhyolite-Basalt Group

This group of igneous rocks is distinguished by a fine-crystalline or stony groundmass which has developed through rapid cooling. They occur as shallow dykes, sills, or laccoliths, or as surface flows, or as erupted fragments. This group includes rhyolite, latite, andesite, and basalt which grade in that order from acidic to basic in composition.

(A) Porphyry

Igneous rocks often cool so that one mineral crystallizes out of the magma first. This causes the formation of larger crystals which are scattered throughout and embedded in a mass of smaller ones. The rock is then said to have a porphyritic texture and is termed a rhyolite porphyry, or an andesite porphyry. This texture is more common in the plutonics than in the volcanics, however.

(B) Tuff

When a violent volcanic eruption occurs, the group of finer fragments ejected is called volcanic ash. At first the ash is a loose material, but soon it becomes cemented into a mass of rock which is usually quite porous and light in weight. This texture is referred to as tuffaceous, and the rock is called a rhyolite tuff, or an andesite tuff, depending on the chemical composition of the magma. If coarse angular fragments are present, the texture is termed a breccia. Basic magmas, due primarily to an absence of silica, do not form tuffs.

(C) Obsidian

Some lavas cool so quickly that crystals do not form. This results in ~~in~~ a glassy texture which is called obsidian. The rock is called a rhyolite obsidian, or a basalt obsidian, depending on the composition of the magma.

(Most obsidian is derived from rhyolite.) Gases may rise through the molten mass while it is cooling. The upper portion of the rock often then becomes filled with gas bubbles, and sometimes becomes frothy. When the cavities caused by these bubbles are large and irregularly distributed, it becomes a scoria.

(2) Plutonics: Granite- Gabbro Group

This group of igneous rocks is distinguished by a coarse-crystalline or granitic groundmass which has developed as deep-seated dykes, laccoliths, and batholiths. The magma has cooled so slowly that all the minerals have crystallized completely and are readily visible to the naked eye. This Group includes granite, monzonite, granodiorite, diorite, and gabbro, which grade in that order from acidic to basic in composition.

(A) Porphyry

A porphyritic texture may also be formed with the plutonics, and these are likewise called a granite porphyry, or a granodiorite porphyry depending upon the composition of the magma.

In proceeding from the acid to the basic rocks, quartz decreases with increasing basicity. It is absent in gabbro. (If quartz occurs in monzonite or in diorite, the rock is termed a quartz monzonite or a quartz diorite.) Also, the alkali feldspar (orthoclase) decreases with increasing basicity, while the soda-lime feldspar (plagioclase) increases. In general, the acidic rocks are lighter in color than the basic ones.

(b) Sedimentary Rocks

(1) Alluvium

Alluvium is an unconsolidated deposit of soil and rock fragments which have been transported by water from their points of origin, and may contain any or several rock types. The rock fragments may vary from angular to well rounded in shape or they may or may not be stratified. This condition

is most commonly that of valley floors. It also occurs at the mouths of canyons along mountain fronts as alluvial fans.

## (2) Sandstone

Sandstone is a rock formed by grains of sand cemented together. The size and shape of the sand grains, and the sort and amount of cement may both vary widely. In general, the rock is quite porous.

## (3) Conglomerate

Conglomerate is a rock formed of sand, pebbles, and cobbles. The pebbles and cobbles may be somewhat rounded by erosion, or they may be angular. (Conglomerates are called *fanglomerates* when the fragments are angular. Sometimes all rocks with angular fragmental material are termed *breccias*, but this term is usually reserved for volcanic tuffs with this characteristic). The origin of conglomerates is always fluvial (carried by water).

## (4) Shale

Shale is a rock formed from clays which have been consolidated. It usually splits into thin layers easily due to a layered or stratified structure.

## (5) Limestone

Limestone is a rock formed by the consolidation of masses of shells which have been somewhat pulverized, or more commonly, it is a deposit of calcium carbonate. Pure limestone is white, but impurities such as sand, clay, and organic material are often admixed. Organic material may cause it to vary from gray to brown or black in color.

## (c) Metamorphic Rocks

Slate, schist, and gneiss represent successive stages of metamorphism in rocks.

### (1) Slate

Slate is a partially metamorphosed shale or tuff or sandstone. It is a rock that will split into thin sheets, and is composed of grains all of

which are too fine to be distinguished by the naked eye. This cleavage is not caused by bedding or stratification of the original rock; it is entirely the result of pressure during the first stages of metamorphism. The color ranges from gray, through red, green, and purple, to black.

(2) Schist

Schist is a further stage in the metamorphism of slate. Only the principal mineral constituents may be recognized by the naked eye. The rock is foliated; composed of thin scaly layers which may be split rather easily. Gradations occur towards gneiss on the coarser side.

(3) Gneiss

Gneiss is an extreme of metamorphism. The rock is banded and coarse enough so that the constituent minerals may be determined by the naked eye. A gneiss splits much less readily than a schist along the planes of schistosity.

(d) Serpentine

Serpentine is a hydrated extremely basic igneous rock. The minerals which have formed at high temperatures absorb water later to make new "hydrated" minerals. On hydration, the rock may greatly expand, and this results in slickening, giving the rock its characteristic greasy or slippery feeling. Serpentine is greenish in color, and is very soft.

(e) Quartzite

Quartzite is a metamorphosed sand or sandstone of pure silica. It is distinguished from sandstone by the almost complete lack of pore spaces, its greater hardness, and its crystalline structure.

5. LIST OF EQUIPMENTMinimum Office

| <u>Amount</u> | <u>Articles</u>                                  |
|---------------|--|
| ✓ 1/party     | Equipment box with lock <i>CF+RES 24716</i>      |
| ✓ Supply      | Letterhead stationery ✓ <i>332</i>               |
| "             | Yellow scratch paper ✓ "                         |
| "             | Envelopes, assorted sizes ✓ "                    |
| "             | Vellum overlay sheets size 9"x11", for field use |
| 1 set         | Cloth " " " " for finished office copies         |
| ✓ 1 doz       | Crow quill pens ✓ <i>332</i>                     |
| ✓ 3           | " " pen holders ✓                                |
| ✓ 6           | Pens size 303 ✓                                  |
| ✓ 2           | Large pen holders ✓                              |
| ✓ 1           | Scripto pencil and indelible leads ✓             |
| 6             | 4H pencils ✓                                     |
| 2             | <i>2H</i> 2H pencils ✓                           |
| 6             | Kipple erasers ✓                                 |
| 2             | Pencil and ink combination erasers               |
| ✓ 1           | Ruling pen                                       |
| ✓ 1           | Flat rule - 12" ✓ <i>332</i>                     |
| ✓ 1 bottle    | Black waterproof ink ✓                           |
| ✓ 1" bottle   | Carmine " " ✓                                    |
| ✓ 1 bottle    | Green " " ✓                                      |
| ✓ 1 bottle    | Orange " " ✓                                     |
| ✓ 1 bottle    | Blue " " ✓                                       |
| ✓ 1 bottle    | Fountain pen ink ✓                               |
| ✓ 1 can       | Oronite fluid for setting colors                 |
| <del>2</del>  | <del>Color setting sticks</del>                  |

- ✓ 1 pkg Absorbent cotton ✓
- 1/quad Increment core box 18" long
- ✓ Supply Form 26 - Monthly Service Report ✓
- ✓ " Form 5 - Memo Travel Expenses ✓
- " Progress report forms
- ✓ " Mileage report forms ✓
- " Form 17a - Leave slips ✓
- " Form 874-16 - Transfer of property slips ✓
- ✓ " Experiment Station change of address cards ✓
- ✓ 2/man Diary forms ✓
- ✓ 1/man Form 289 - Pocket notebook ✓
- ✓ 1/man Engineers' rule ✓
- ✓ 1 pdk Franked mailing labels ✓

Optional Additional Office Available

- Tabulation paper
- Carbon paper
- Small stationery envelopes stamped Director
- Ink blotters
- No. 2 pencils
- 2H pencils
- ✗ Triangles - 45° and 30° x 60°
- Artist fingers
- ✓ Sandpaper pad for pencils ✓
- ✓ Paper clips ✓
- ✓ Rubber bands ✓
- ✓ Thumb tacks ✓
- ✓ Glue ✓
- ✓ Scotch tape ✓

## Minimum Mapping

| <u>Amount</u> | <u>Articles</u>   |
|---------------|---|
| 1             | Type Map for finished copy  |
| 1             | Type Map for extra mapping  |
| 1             | Supplementary Map for finished copy                                 |
| 1             | ( $\frac{1}{2}$ " ) " Map for extra mapping                         |
| 1             | Geological overlay if available                                     |
| 1             | Forest Service recreational map if available                        |
| 1             | Extensive Type Map if available                                     |
| 1             | Forest Service Topographic Survey Type Map if available             |
| 1             | Blister Rust Type Map if available                                  |
| 1             | Forest Service Timber Survey Type Map if available                  |
| 1             | U. S. G. S. Type Map if available                                   |
| 1             | Road map if available   |
| 1             | Fire map if available   |
| 1 pad         | Township plats  |
| 1 copy        | Manual of Field Instructions  |
| 1 copy        | " A Manual of Flowering Plants of California" by Jepson <i>2000</i> |
| ✓ 1/man       | Leather pencil holder for pocket <i>1000</i>                        |
| ✓ 1/man       | Canvas carrying case  |
| ✓ 1/man       | Letter-sized tatum  |
| ✓ 1/man       | Abney hand level  |
| 1/man         | Diameter tape   |
| 1/man         | Increment borer   |
| ✓ 1/man       | Pocket compass  |
| 1/man         | Ball chalk line 100'  |
| ✓ 1/mapper    | Binoculars  |
| 1/man         | Metal increment core container                                      |

- ~~1/man~~ Large knapsack or pack board
- ✓ 1 Hand lens
- ✓ 2 Plant presses
- ✓ Supply Blotters for plant press
- ✓ " Specimen papers
- ✓ " Seed envelopes
- ✓ " Sample plot forms, both C.F.E.S. #1 and C.F.E.S. #2
- ✓ " ~~Site index determination forms~~
- 2 sets/mapper Mapping pencils
- 4 Pencil clips
- ✓ 1/man Forest Service badge
- ✓ 1 Forest Service key
- 1 Forest Service padlock

#### Optional Mapping Equipment

- ✓ Ranger notebook form 874-C
- Extra pencils for types which cover larger areas
- ~~Camera 3A or larger, with tripod\*~~
- Photographic forms

#### Automobile Equipment

| <u>Amount</u> | <u>Article</u>                              |
|---------------|---|
| 1             | ✓ Shovel, large                             |
| 1             | ✓ Axe                                       |
| 1             | Canvas tarpaulin for truck <i>ordered</i>   |
| 1 book        | ✓ Form 877                                  |
| 1             | Rope to tie down load <i>supplied</i>       |
| 1             | Large Bullard first aid kit <i>supplied</i> |
| 1 set         | ✓ Skid chains <i>2 mounted</i>              |
| 1 set         | Tools - wrenches, pliers, jack, etc         |

\* Subject to approval of project leader

1 box            Extra fuses ✓  
 1 set            Extra globes ✓

**Minimum Camping**

| <u>Amount</u> | <u>Article</u>                      |
|---------------|-------------------------------------|
| ✓ 1           | Campcook stove (3 burner)           |
| ✓ 1           | Cooking outfit - 4-man              |
| ✓ 1/man       | Canvas covered camp cot             |
| ✓ 1/man       | Single oilcloth covered mattress ✓  |
| ✓ 1           | Gallon canteen ✓                    |
| ✓ 1/man       | One pint bottle type canteen ✓      |
| ✓ 1/man       | Snake bite kit ✓                    |
| ✓ 1           | Small first aid kit ✓               |
| ✓ 1           | Coleman lantern                     |
| ✓ 6           | Mantels for Coleman lantern         |
| ✓ 1           | Extra generator for Coleman lantern |
| ✓ 1           | Carborundum stone                   |

**Optional Camping Equipment Available**

Water pail  
 Wash tub  
 ✓ Dish pan  
 ✓ Wash pan  
 ✓ Flashlight and batteries  
 ✓ Tent 7x9

NE  
Forest Survey  
Type Map

May 15, 1935

MEMORANDUM FOR ALL CREWS

Albertus  
Belt  
Butter  
Sindel  
Gifford

Nordstrom  
Lee  
Axelrod  
Wilson ✓

In order to make the work more consistent and before the new instructions come out, here are some suggestions:

All plots will be black circles. Where a grass plot is taken with another plot it will be given the same number and clipped to the other plot. There will be no differentiating color for grass plots.

Sites will be green squares.

Route of travel in the car should be solid green line. Route of travel hiking will be broken green line.

Saw mill locations which have been abandoned, a hollow derby hat.  Saw mills operating, a solid black derby hat.   
Notes should be taken on these when possible.

Norman French  
per L.H.  
NORMAN FRENCH