

Vegetation Classification—California¹

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Vegetation classification is in a state of disorder; it is therefore a subject of concern to many people. Many different systems are in use throughout California. They do not focus on specific zones within the State, but instead on particular kinds of vegetation (frequently a result of resource management emphasis) or on a particular community or type definition (table 1). Consequently, several systems may be used in a given portion of the State--often on a single limited acreage.

The variety of vegetation classification systems now in use causes serious interdisciplinary communication problems. The divergence of principles behind the systems creates confusion, both to those who compare classification results, and to those who use the systems and try to communicate information.

The need for a common system for classifying vegetation has increased over the years, growing more severe and urgent as classification in the State has become more complex. We are attempting to meet that need with a system that approaches the required universality.

The form of the new California vegetation classification system reflects a careful evaluation of the role of such a system and the requirements of one that would serve as a common classification language. Vegetation classification in California lends itself well to such evaluation because it is the result of an evolutionary process. By reviewing this evolution, we can see how the goal of a classification system affects its form, and how confusion results from attempts to make the system accomplish goals beyond its proper role. On this basis, the rationale for the new system can be better appreciated, and its application understood.

THE IMPACT OF CHANGE

As needs have evolved, vegetation classification systems used in California have changed in

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Abstract: Vegetation classification in California is evolving rapidly. Broad-brush classes generated by resource management functions and ecologists are not suitable for many current needs. A new California system for vegetation classification fills many current needs for communication between disciplines and for linking existing classification systems.

emphasis and in the intensity of classification they provide. This evolution has been influenced by different schools of vegetation ecology (mainly Clements, Braun-Blanquet, and Daubenmire), by various resource management disciplines, and by the distribution analyses of taxonomists and other botanists. The evolution reflects a refined awareness of the nature of vegetation in the State, and a refinement of resource management and research goals.

The systems used in California reflect highly specific goals. Increasing specialization in both resource management functions and academic disciplines has led to creation of many single-purpose classification systems that categorize vegetation from a particular perspective. Often these systems go beyond mere categorization and classify such characteristics of vegetation as its suitability for a particular use, the nature of its dynamics, or its environmental affinities.

The changes that have occurred, with their resulting problems of communication between users of different systems and of complexity in the systems themselves, are not unique to California, as a review of the literature will show (Whittaker 1962, Shimwell 1972). What is unique is the relatively short period of time over which the changes have occurred, and the impact they have had on the overlapping activities of a mobile and diverse group of people. This impact has stimulated practitioners and researchers to evaluate current methodologies and the trend of thought they represent, and to ask if there is a better course of action.

A HISTORICAL PERSPECTIVE

California's early explorers left records describing vegetation in broad terms.³ They recognized and described broad physiognomic patterns on the landscape, and did not classify with more precision until the need arose. Consequently, they left descriptions of grasslands in our valley bottoms, zones of chaparral and conifers, and riparian vegetation along streams.

³Extracts from the files of Albert E. Wieslander, Pacific Southwest Forest and Range Experiment station, Berkeley, Calif.

Table 1--A cross section of predominant vegetation classification systems used in California during the 20th century. The emphasis of timber and range resource management systems can be compared with the more general systems of Munz (Munz and Keck 1963) and Wieslander (1935).

Timber cover types (Show and Kotok 1929)	Forest type group and (*) timber management types (Bolsinger 1980)	Vegetation types (Wieslander 1935)	Plant communities (Munz and Keck 1963)	Range grazing types - 1937 (Stoddart and Smith 1943)
Western yellow pine Mixed conifer Douglas-fir Sugar pine/fir Fir	Ponderosa and Jeffrey pines Redwood Douglas-fir True firs *Mixed conifer/Douglas-fir/ sugar pine *Mixed conifer Lodgepole pine Incense-cedar *Other conifers	Pine Redwood Douglas-fir Fir Pine/fir Lodgepole and white pine Whitebark and foxtail pine Spruce Miscellaneous conifers	North coastal coniferous forest Closed cone pine forest Redwood forest Douglas-fir forest Yellow pine forest Red fir forest Bristlecone pine forest Lodgepole forest Subalpine forest Northern juniper woodland	Conifer Pinyon-juniper
Woodland	Hardwoods	Pinyon-juniper Woodland Woodland-grass Woodland sagebrush	Pinyon-juniper woodland Mixed evergreen forest Northern oak woodland Southern oak woodland Foothill woodland	Broadleaf trees
Chaparral		Chaparral Chamise chaparral Timberland chaparral Semidesert chaparral Woodland chaparral	Chaparral	
Brush		Sagebrush	Northern coastal scrub Coastal sage scrub Sagebrush scrub Shadscale scrub Creosote bush scrub Alkali sink	Browse shrub Sagebrush Creosote Mesquite Saltbush Greasewood Winterfat Desert shrub
Grass		Meadow Grassland	Coastal prairie Valley grassland Alpine fell-field	Half shrub Grassland Short Tall Meadow Perennial forb
		Marshland	Coastal salt marsh Freshwater marsh Joshua tree woodland	Annuals
			Coastal strand	Barren Waste

During the late 19th and early 20th century, botanists, taxonomists, and dendrologists--such as Kellogg (Kellogg and Greene 1889), Abrams (1912), Parsons (1966), and Sudworth (1967)--were exploring the State in order to catalog its plant species. Their approach was still to identify broad physiognomic patterns of vegetation and life zones.

The need to address and describe vegetation as an entity, rather than a collection of individual species, began to emerge with interest in California's vegetation as a resource. The two predominant resources in California, timber and range, gave rise to divergent management views of vegetation.

Forested areas in California were addressed in broad classification systems that reflected an interest in timber production. Such vegetation types as Pine, Fir, Redwood, Mixed Conifer, and Brush were described (Show and Kotok 1929, Wieslander and Jensen 1946). Emphasis was placed on conifers, northern California, the Sierra, and the few forested areas of southern California. This emphasis has been frustrating to people with an interest in Mediterranean vegetation, because it virtually ignored the Mediterranean climate regions of California.

Range managers also classified vegetation in broad terms (Stoddart and Smith 1943), but they generally attempted to describe local stands in detail (Beeson and others 1940; U.S. Dep. Agric., Forest Serv. 1969). Range managers were naturally concerned with short-term succession because of the way vegetation on annual plant rangelands varies from year to year in response to vagaries of weather and use. They evaluated the successional status and degree of development of each stand, much along the lines of the Clementsian school of ecology (Weaver and Clements 1938). Being so concerned with the complexities of herbaceous vegetation dynamics, range managers made little attempt to recognize precise communities or precise vegetation types, and confined their system to broad classes, qualified stand by stand.

An interest in vegetation ecology resulted in Cooper's study and classification of the sclerophyllous vegetation of California (Cooper 1922). He addressed vegetation in much the same manner as Clements, but saw little need to give climax communities and seral communities different nomenclature. Cooper's work bears the mark of its time; his classification was broad, but he recognized the variability that exists within California's sclerophyllous communities.

As general resource management abilities became refined, and the need was felt to understand the dynamics and ecology of our vegetation more fully, interest arose in recognizing and describing the variability in California's vegetation more precisely than in the past. In the 1930's, fire management planning in southern California gave impetus to an ambitious classification and mapping

of California's vegetation (Wieslander 1935). In this effort, Albert Wieslander also addressed broad physiognomic patterns of vegetation, but recognized subclasses of these types in greater detail than anyone before him. He also described dominant plant species within each subtype. The results of his work are found in many vegetation maps produced by the California Forest and Range Experiment Station (Critchfield 1971). This effort resulted in California's chaparral being broken down into more than one class (table 1). Wieslander's work has been abstracted and modified in various ways to meet the vegetation classification needs of wildlife managers (Jensen 1947) and timber managers (Wieslander and Jensen 1946). His influence is seen in the way others have since mapped and described California's vegetation.

In later years, Philip Munz developed a vegetation classification system to facilitate the use of his California Flora (Munz and Keck 1963). Because it accompanied his Flora, it has become one of the most popular systems in the State. It is not a true vegetation classification system, but rather identifies a broadly conceived set of biological communities characterized by specific kinds of vegetation. It also shows the influence of timber and range interests (table 1). His plant communities lean heavily towards forest and rangeland vegetation, and chaparral is relegated to a single class.

THE PRESENT

Today, the general classes typical of past systems are unsatisfactory for many current needs. For example, the broad timber types do little to promote understanding of forest vegetation in terms other than timber production. Even Wieslander's work is still too general for many specific needs. Munz' system is too ambiguous for site-specific application.

Interest in vegetation ecology and plant ecology has generated divergent systems for characterizing vegetation types, plant ecosystems, and biological communities wherein plants reside. Habitat types, after the manner of Daubenmire (1968), have been described for some northern conifer forests by Sawyer and Thornburgh (1977), and a system of biological communities has been developed by Thorne (1976). Cheatham and Haller listed habitat types, with subdivisions, identified within the University of California Natural Land and Water Reserves System. Their habitat types are equivalent to Munz' plant communities, and the subdivisions show sensitivity to habitat variability.⁴ Southern California's vegetation is addressed in a biome system developed by Brown and

⁴Cheatham, Norden H., and J. Robert Haller. An annotated list of California habitat types. 1975. (Unpublished manuscript).

Lowe for the southwestern United States (Brown and others 1979). Vegetation characteristics of many specific localities have been described by various authors (Hanes 1976, 1977; Vogl 1976; Minnich 1976; Horton 1960), whose descriptions range from broad physiognomically defined zones to detailed vegetation types developed through the interpretation of aerial photographs.

Current understanding of California's vegetation and its ecology has been summarized recently in a volume edited by Barbour and Major (1977). Although this work does not address the classification of vegetation as such, it contains a map of California's potential natural vegetation--with a legend--by Kuchler.

The vegetation descriptions in all the work I have mentioned were developed in support of specific technical activities, ranging from timber management to pure vegetation ecology, and their level of abstraction reflects specific viewpoints. As a result, we have not had a single system for classifying vegetation that has been generally satisfactory.

The direct impetus to develop a widely acceptable treatment of California's vegetation comes from resource management. Those responsible for the various resource management functions find that they must understand the nature and dynamics of vegetation in more precise terms. They also recognize that people in different functions can work together easily if there is a common language to describe the vegetation resource, but not when each function relies strictly on its own technical classification system.

Although researchers and resource management specialists in California agreed on the need for a system that would be usable by most professionals, they were uncertain as to its feasibility. The patterns of vegetation people recognize are strictly a reflection of their particular needs, their training and background. To determine feasibility, extensive testing was carried out with individuals from a variety of disciplines, resource management agencies, and academic pursuits (Paysen and others 1980). A unit of vegetation was identified as one that all people who deal professionally with vegetation recognize; it was called the Association, and was adopted as the basic unit of the new classification system for California.

A NEW VEGETATION CLASSIFICATION SYSTEM

The new system is a component vegetation classification system; it addresses just the vegetation component of ecosystems. It does not address the ecology of vegetation, nor does it explain phytosociological relationships. It follows that the system is "neutral" with regard to plant community succession; it can be applied to seral vegetation, potential vegetation, or climax vegetation.

The system is designed around an aggregative hierarchy, its focus being a site-specific plant community. The same plant community is traced upward through the hierarchy at decreasing levels of descriptive precision (table 2). The system's focus and hierarchical design make it a flexible tool for crosswalking between other vegetation classification systems. They also make it adaptable to many phytosociology and other ecology-based schemes for analyzing plant communities and explaining their dynamics.

The elements that distinguish communities and provide the basis for community nomenclature are readily discernible, and are common to people's perception of vegetation character. The system is therefore usable by a wide range of people. The system distinguishes the physiognomic character of communities as well as predominant floristic differences.

The system's basic unit, the Association, is named in terms of the dominant overstory species and the dominant species in subordinate layers (dominance is based upon relative crown cover within a layer). Under strict rules of nomenclature, codominant-associated species can be included in the Association name. Associations are aggregated into Series according to dominant overstory species. The Series are, in turn, aggregated into Subformations according to leaf and stem morphology. Subformations are finally aggregated to Formations on the basis of the growth form of the overstory species.

An additional category, called Phase, is provided to facilitate the link to existing vegetation classification systems. It is flexible and can be used to describe such things as stand age, condition, or stage of development. It can be

Table 2--The hierarchy of the new California vegetation classification system, with classification criteria for levels and examples of classes within each level.

Level	Criteria	Example
Formation	Physiognomy	Woodland
Subformation	Stem and leaf morphology	Broadleaf woodland
Series	Dominant species in overstory	Canyon live oak
Association	Dominant species in all layers	Canyon live oak/ shrub live oak mountain lilac
.....		
Phase	Flexible: user criteria	Age 40 yr; crown cover 40 pct.

applied to any level in the classification hierarchy. Phase does not enter into the formal classification of plant communities, but is used as a qualifier once the community has been classified.

The Phase provides a logical point of entry to the classification system from technical systems that are based on a particular functional perspective. By describing Phases in timber management terms, and aggregating some classes, we reach standard timber types; if the classes are left unaggregated, they provide a good framework for silvicultural prescriptions. By defining Phases that describe local site indicators, we relate the Associations to the scheme for addressing vegetation employed by the Zurich-Montpellier school of phytosociology (Becking 1957). At upper levels of the system's hierarchy, vegetation units can be combined with climate, geography, and soils data, resulting in community descriptions that fit the UNESCO (1973) system for classifying and mapping vegetation on a worldwide basis.

This is a system for classifying vegetation rather than a classification of vegetation. It does not limit a user to a preconceived set of classes; instead, it allows a user to identify communities as they actually exist. The rules for class recognition and definition, as well as those for nomenclature, are such that a significant amount of information can be conveyed about a community with a class name--and perhaps with a Phase designation.

The new California system underwent extensive field testing over a period of several years, and has proven to be a good crosswalking mechanism. It is a good vehicle for communicating information about vegetation between a variety of disciplines, and an excellent framework to use in developing an understanding of vegetation dynamics. The system fits well with existing systems for classifying vegetation or abstractions from vegetation (such as timber types and range types), and for classifying the processes of vegetation dynamics.

The system is compatible with those being used in adjacent States. Correlations can be defined between the Association and the plant communities being classified in Oregon and Washington (Hall 1973, 1976), and the Associations being described in the Southwest (Brown and others 1979). It is also directly compatible with the vegetation classification system current under development for use at the national level.⁵

⁵Merkel, Daniel L., Richard S. Driscoll, Darrel L. Gallup, James S. Hagihara, Donald O. Meeker, and Dale E. Snyder. National site (land) classification system - status and plans. 1980. Resources Evaluation Techniques Program, Rocky Mountain Forest and Range Exp. Stn., Fort Collins, Colo. Unpublished.

The California system is continuing to be evaluated by individuals from a variety of disciplines, agencies, and universities throughout the State of California. The system can become the framework for coordinating vegetation classification, inventory, and vegetation ecology activities throughout the State.

I emphasize again that the new system is strictly a vegetation classification system. The system will not detail ecological processes, nor will it describe productivity. It is simply a framework to use for describing vegetation--past, present, and future. Managers and scientists should describe each vegetation class in a manner reflecting the ecological relationships of the species in and among the classes. Descriptions can reflect the productivity of plant communities defined by the classes in terms of timber, range, or any other kind of production that may be of interest. Classification of vegetation should be distinct from ecology, resource management, or other technical activities. Because the California system has been designed under this philosophy, it will have maximum application and usefulness.

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