THE SAMPLER
PERIODIC NEWSLETTER OF THE CNPS VEGETATION COMMITTEE
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Overview of the Revised Vegetation Assessment Strategy of the CNPS Vegetation Committee:

In the spring of 1992 the CNPS Plant Communities Committee ran a two-day training session for CNPS chapters at the University of California James Reserve in the San Jacinto Mountains. The main purpose was to introduce a reliable and easily learned method of vegetation sampling that could be conducted by CNPS volunteers state-wide. Its intended use was primarily to determine the quantitative definitions of rare and unusual vegetation. This methodology has become known as the "CNPS Point-Intercept Method" and has been used widely throughout the state not only to determine rare vegetation, but to monitor and define many types of more common or typical vegetation. The protocol was published as an appendix to the 1995 edition of *A Manual of California Vegetation* (MCV). The protocol has proven useful in defining several types of rare vegetation including sycamore alluvial woodland, southern maritime chaparral, Riversidean alluvial fan scrub, Ione chaparral, among others. Almost five hundred point intercept surveys have been entered into the California Vegetation Information System and will be used to refine and define vegetation types in the second edition of the MCV.

Since that time, with the widespread use of the MCV and the expansion of quantitative vegetation assessment throughout California, there has become a need to devise additional methods to obtain information on not just rare, but all types of vegetation. Philosophies about conservation and management of ecosystems have evolved over the past several years. Conservation planning now emphasizes the full range of ecological variability of any area much more than it did a few years ago. More emphasis is now being placed on the importance of all types of vegetation in a given landscape. Thus, there is a widespread need to quantitatively determine the identity and distribution of all vegetation throughout the state.

Although the Point-Intercept Method is easy to learn and functions in a wide variety of vegetation types, it involves a relatively slow and tedious sampling process that requires significant modification when in certain types of vegetation. With the advent of detailed quantitatively defined vegetation mapping throughout California over the past several years more streamlined methods of sampling have taken favor. These methods have relied on rapid estimates of species cover over plots of varying sizes rather than meticulous repeat measurements in unvarying sized plots.

Included in this edition of "The Sampler" are descriptions of two new protocols for obtaining information on vegetation. Both of these vegetation assessment methods have been developed to maximize the amount of information obtained for the time devoted. Although once learned,

they are very flexible and efficient methods they require some additional training. The releve technique is our answer to a faster and more adaptable means to obtaining detailed classification and monitoring information. However, it will be necessary to familiarize first-time users with such concepts as cover estimation and appropriate sizes and shapes of plots. The "Series-a-Thon" Protocol is a reconnaissance-level method that will be used to obtain information on the extent of all vegetation in relatively large, ecologically defined areas.

These methods when used in conjunction with one another will provide large quantities of valuable data on the distribution and the definition of vegetation that can be entered into already existing databases for summarizing and archiving. These data will, in turn, be used to modify and improve statewide vegetation classification and conservation information. The most direct use will be to feed information on distribution definitions, and disturbance effects into the next version of the MCV.

The two methods are complementary and can be used as a two-stage assessment of any area's vegetation. CNPS chapters will be instructed in the two protocols by a group of designated trainers. These trainers will, in turn, be taught by developers of the methods. The CNPS Vegetation Committee will conduct two separate weekend sessions in the spring of 1999 - one in Southern California and one in Northern California. We expect the reconnaissance level "series-a-thon" will provide a sense of what types of vegetation exist in a given area. Some of the vegetation types noted in the series-a-thon will be poorly defined in the current classification system. These poorly understood or unknown types will be identified and located and will then be prioritized for more detailed assessment using the releve protocol.

The following descriptions are intended as introductory material and not as stand alone instructive documents. We would like as many CNPS members and other interested individuals to be aware of the general considerations of these techniques prior to actually using them. However, we would expect that the majority of users go through training before setting out on their own. Currently plans are being finalized for training sessions at Point Reyes National Seashore, Marin County and in the vicinity of Figueroa Mountain in Santa Barbara County. These sessions will occur in March and April 1999. Additional planning material will be sent out to plant community representatives for all chapters within the next month detailing information on times and locations and accommodations. Please feel free to contact Todd Keeler-Wolf (916-324-6857, tkwolf@hq.dfg.ca.gov) with any initial questions you may have.

The Series-A-Thon Concept

Background:

The release of the MCV heralded a new state-wide perspective on vegetation classification. The premise of the book — all vegetation can be quantified based on cover and composition of plant species, yielding a uniform defensible definition of vegetation units — has proven to be very useful throughout California and the rest of the Nation. The MCV has become the standard reference on California vegetation and has been adopted as the standard approach to classifying vegetation statewide.

As writing goes forward on the second edition of the book (to be published within the next two years), revisions are being made to all descriptions. One of the most important aspects of the revisions includes geographic updating. At this time only about 20% of the state's vegetation is being mapped at the series level. Although the value of statewide, series-level mapping is enormous, there has been no mandate to produce a detailed California vegetation map. Thus, work proceeds in a piecemeal fashion and the entire state may take many years to be covered. In lieu of a California series-level vegetation map, we are seeking information on specific locations of all series based on geographic subdivisions known as ecological subsections.

In the revised edition of the MCV, the existing "modified Jepson" ecoregional geographic scheme will be replaced with a more standardized and accurate ecoregional geography with the "ecological subsection" as its basic unit. Ecological subsections are defined by a combination of geology, soils, climate, and potential (climax) vegetation. They are intended to be used as ecologically-based units of conservation and natural resource planning (Bailey 1994). As with the CNPS vegetation classification concept of "series", ecological subsections are a hierarchical entity within a standardized classification of ecological units (Ecomap 1993).

Subsections are, like series, at the mid-level of their respective classification. However, they are not the same as a vegetation unit. California's subsection boundaries have been developed by a team of soil scientists, geologists, physical geographers, and vegetation ecologists. The unit boundaries are defined from a combination of relatively coarse-resolution geology, soil, climate, and vegetation. Maps (Goudey and Smith 1994) and a physical description of each (Miles and Goudey 1997) have been published. The descriptions include soils, geology, geomorphology, climate, potential vegetation, and existing vegetation series.

The vegetation portion of a given subsection description was written based on inquiries made of vegetation experts statewide. However, much about the geography of vegetation remains uncertain in this state. There are remote areas and little-visited areas of private land. In addition, we are working with a new classification, its parameters largely untested. Thus, concepts of distributions and how the series vary geographically are often sketchy. To obtain more accurate understanding of the distribution of the vegetation types nothing short of systematic inventory will suffice.

CNPS and other volunteer organizations can greatly advance the current distributional

understanding of vegetation. We have a strong need to verify locations of vegetation units and more general information about their composition. This information will feed into the geographic descriptions in the MCV and will also be depicted on the geographic interface of the subsection map viewable on the MCV website: http//:davisherb.ucdavis.edu/cnps Activeserver/index.html). It is the next best thing to having a complete state-wide series level vegetation map.

Why do we need to know about the distribution of vegetation?

- to have a more accurate understanding of the commonness and rarity of different forms of vegetation throughout the state
- to link the distribution of various rare and threatened plant species with the vegetation units
- to provide a clearer picture of relationships between vegetation types
- to help prioritize community-based conservation goals based on the local representation of unique types, high diversity areas, etc.
- to do the same for regional vegetation throughout the state and the nation.

Additional values:

- to learn how easy it is to identify vegetation
- to get excited about vegetation and become interested in furthering the vegetation knowledge base for California
- to motivate people to do more to help identify, protect, and conserve vegetation in your area

The Plan for Use:

We hope CNPS chapters and other organizations will provide us with distributional information to update the location of series for the second edition of the book. We envision the effort in the form of a "series-a-thon", where groups would work together in selected ecological subsections of their choice to gather distributional information on vegetation. The efforts would be concentrated over a short period (a weekend for example) with the ending session where all participants would collate and share their information. At the same time, this volunteer-based geographic inventory of series will provide information on new vegetation types and modifications to the existing vegetation classification and keys based on their extensive use by CNPS volunteers. In this way the keys and descriptions will be improved and potentially, new types of vegetation will be recognized, which will be described in the second edition.

The data collected will be entered into a computer database, already set up to inventory the location of series by each ecological subsection. We will add to a database that was developed to populate the CNPS series by ecological subsection web map and will add fields called "date of entry", "field verification date", etc. This new information will be directly linked to a digital map of ecological subsections now available on our website. Thus, the same information will be added to the second edition of the MCV.

Prioritizing the selection of subsections for inventory:

There are 224 subsections in California. Each of the subsections are fair game for inventory by the method proposed in the following pages. Of lower priority are areas where we have completed or have currently ongoing series-level mapping projects. These include the northern,

eastern, central and southern Mojave Desert, Anza-Borrego Desert State Park and environs, Point Reyes National Seashore, Golden Gate National Recreation Area, the Marin County State Parks, and Suisun Marsh.

In general, the highest priority areas of the state are those exposed to the greatest human impacts. Thus, long standing areas of human modification such as the Central Valley, and south, central and north coastal California are top priority areas. However other recently affected parts of the state (the Sierra foothills, desert population centers such as Coachella Valley, and Western Mojave) also require immediate understanding of the series distribution. There is, of course, no set system of priorities. The best results often come from collaborators who enjoy what they're doing. Thus, we support an inventory of any subsection the chapters wish to work on. Some may wish to combine a high priority one with a "fun" one, say in the mountains or the transmontane area.

Strategy for Rapid Assessment:

To be most effective, a fair amount of planning should go into the survey of a given ecological subsection. This planning should involve:

- group consensus on which ecological subsections to choose
- determining the number of participants
- identification of a coordinator (who would organize the distributing of forms, collecting and sending in forms, coordinating meeting and rendezvous points, etc.)
- appropriate training on identification of vegetation (provided by local experts with assistance from vegetation committee members)
- distribution of basic information to all participants (veg keys, maps, floras, field forms, etc.)
- determining the optimum time to make the inventory for species id/comfort/beauty
- planning the mission (breaking into small mobile teams, determining best routes of travel for most complete coverage, determining appropriate duration, or time available/what can be accomplished)
- planning the post-inventory debriefing (need a coordinator to tally forms, should try to have an all-participant meeting to discuss and collect findings).
- submit findings to NDDB/vegetation ecologist
- state-wide publication of results in next edition of Sampler/possible Fremontia article, etc.

Training and other Information to assist you:

The members of the CNPS vegetation committee want to help chapters with this project. To kick off this effort we would like to set up two training sessions with northern and southern California chapter participants. The training will be hands-on and will include an inventory of a given ecological subsection. The training sessions will be held in conjunction with training on a more detailed vegetation sampling technique called the releve (see companion article). Training sessions will be two full days and include one day devoted to each technique with a summarization session at the end. The training sessions will be at Point Reyes National Seashore and at University of California Sedgewick Reserve in Santa Barbara County. A sign up flyer will be circulated to all chapters by mid January 1999.

In addition to the training, through cooperation with the US Forest Service we will be able to provide you with copies of local vegetation guides, copies of the subsection descriptions and

maps. The CNPS vegetation committee will provide extra copies of the MCV for use in the field and all training. DFG will provide copies of ecological subsection boundaries for overlay onto local topographic maps and DeLorme atlas pages. You may obtain free copies of the subsection map and subsection descriptions by writing to David Diaz, Regional Ecologist, USFS 630 Sansome St., San Francisco, CA 94111.

Description of Protocol:

Introduction:
This protocol will give anyone the basic understanding of this exercise. It is not meant to be a substitute for the training session where people will gain familiarity with field identification of series. It is more an introduction to the methods and anticipated results of a series-a-thon.

The best approach to this endeavor is to consider this as an enjoyable way to get to know a chosen subsection of the state. Viewing the landscape as a series of vegetation types is an effective and enlightening perspective for an ecological understanding of any area. It initiates begin thinking about the environmental controls over the species of plants and animals that make up an ecosystem - slope changes, aspect differences, soil types, geology, local microclimates, etc. All have a role to play in the pattern of existing vegetation, as do physical processes such as fire history, flooding, and other human-mediated, animal, or more natural disturbances.

We will leave it up to the individual chapters how they may want to do this. The characteristics of each of the chapters and their personalities will determine their participation. Some may want to take this as a serious exercise with much planning and with nothing left to chance. Some may want to think of this as a friendly competition within or between chapters for a weekend outing. Others may wish to link it with more detailed work on sampling of vegetation using the releve protocol, or in conjunction with rare plant surveys of different vegetation types.

Questions that will help focus the vegetation series inventory:

- does the area of interest have a good network of roads/trails?
- does the area have large areas of wilderness or relatively inaccessible lands?
- can the area be easily and thoroughly covered in a short period?
- Are there enough people/vehicles/time to do a reasonably thorough job?

Basic Necessities:
1. a group of people with vehicles
2. series keys for each team copied out of the MCV
3. sufficient copies of the series identification field form for each team
4. copies of maps with ecoregional boundaries for each team
5. De Lorme atlas and/or USGS topographical maps or other (e.g., Wilderness Press) maps for locating examples of series
6. a central meeting place for pre- and post-session gathering
7. compass

Optional Equipment:

GPS
camping gear county
soils survey
geological maps
clinometer cellular
phones

Basic Rules:

- groups decide if they will work together or competitively
- if cooperatively then will subdivide the subsection(s) in question for each team
  competitively they may wish to travel same routes and see which group can amass the largest number of series
- teams will plan routes to include the highest potential variety of vegetation
- at each stop along the route one member of the team will update a tally of the types seen on the printed list derived from the existing database housed at NDDB.

- For each new series or association added a new field form must be filled

Hypothetical Itinerary:

Chapter Meeting several weeks before event:

- select coordinator and participants
- select subsection(s) for assessment,
- identify meeting place (pre- and post-)
- notify Vegetation Committee Chair of plans

Saturday AM of event:

- all participants meet at predetermined site
- coordinator provides each team with keys, maps, field forms, surveys specific to area
- coordinator goes over basic rules
- each team shares info on their travel plans, including phone numbers (if using cellular phones)
- all agree on rendezvous time

Saturday AM through Sunday AM:

- teams travel predetermined routes
- each time a series is encountered for the first time: 1) a field form is filled out, 2) the series is added to the growing list for each team, and 3) a location is logged on map of choice and or in GPS

Sunday PM:

- all teams return to meeting point by predetermined time
- coordinator asks representative of each team to summarize their findings including total series encountered, any problems with identification, new types identified, etc.
- discussion of validity of each series tallied (coordinator takes notes)

- group discussion of success of mission; what areas were missed, over-emphasized, under-emphasized, what they might do differently
- coordinator collects field forms and thanks all for the good work
- coordinator deems a "winner" if in competitive mode

Following Weeks:
- coordinator writes short summary of event and includes questionable occurrences, etc.
- coordinator submits all field forms to vegetation committee chair for archiving
- vegetation committee chair receives information and immediately reviews
- chair consults with local coordinator about any issues of uncertainty
- chair has data entered into geographic database.

Literature Cited:

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Goudey, C.B. and D.W. Smith, eds. 1994. *Ecological units of California: Subsections (map)*. USDA Forest Service, San Francisco, CA, Scale 1:100,000; colored.

McNabb, W.H. and P.E. Avers, eds. 1994. *Ecological subregions of the United States: Section descriptions*. USDA Forest Service, Washington D.C. Publication WOWS A-5.

Miles, S.R. and C.B. Goudey. 1997. *Ecological subregions of California: Section and subsection descriptions*. USDA Forest Service, Pacific Southwest Research Station, Berkeley, CA. Publication R5-EM-TP-005.

CNPS Vegetation Program Series-a-Thon Field Form

Draft 12/2/98

Ecological Subsection number: CNPS chapter
Ecological Subsection Name: _ Date: / (MM/DD/YY)
Name of Participants:

Contact Person: Address:
Phone:

Approximate location: (select method below; need only be done for first occurrence of each new series, additional locations optional)
7.5' Topo sheet: _____
Dots on DeLorme atlas sheet or other map (copy of map showing location attached) _____
GPS: Northing_____, Easting _____or Lat. ___", __' __"; Long. ___° __' __"

Approximate elevation (list separately if noting multiple occurrences, circle ft or m):

General slope exposure (and number of occurrences on each) NE_ _, SE_ _, SW_ , NW

List up to nine major species (indicate whether tree, shrub, or ground layer) with approximate cover (note cover class or percent) for each species (Jepson nomenclature please):

Name of Series:_____
Name of Association: (optional): _____
Number of encounters of this series by this team: _____ Is this type listed as sensitive in most recent (1998) NDOB list?: Y, N (circle one)

Dominant Layer: Tree, Shrub, Ground (circle one)
How was this verified (please circle, if multiple i.d.s please list number by each method) walkthru__, binocular survey__, aerial photo__, other _____
Is this type described in the MCV? Y, N (circle one). Did it key in the MCV? Y, N (circle one)
If not why not (no matching dominant species, different mix of subordinate species than indicated, other?)_

What determines the boundaries of the type? (please circle as many as appropriate and if multiple sightings note approx. percent of each,):
disturbance history (e.g, edge of fire, land slide, flood plain, edge of water/active channel, avalanche chute, geologic fault) ____ topography (northeast versus southwest slope, slope steepness, valley, slope, or ridge) _____ geology (specific change in rock type or outcrop) _____
soils (specific change in soil texture, series) _____
unnatural disturbance (logging, road, agriculture, or other (which?) _____
other/unknown (please explain): _____

Other Comments (interesting/rare species associated, animals associated etc.):

How common is this type in the subsection (circle one) (to be filled in after assessment in collaboration with other crews)
abundant (encountered on numerous occasions by all crews, covers large percentage of subsection)
common (encountered by all field crews in all parts of subsection, but not extensive)
occasional (encountered by more than half of crews in subsection, but not on every path traveled)
uncommon (encountered by less than half of crews, occurrences limited to relatively unique situations)
rare (encountered less than 10 times by all team members)
Note approximate total acreage of type in the subsection (to be tallied by series-a-thon coordinator) _____

RELEVE PROTOCOL
CNPS VEGETATION COMMITTEE
Draft #2, November 20, 1998

Introduction

In *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995) CNPS published a Vegetation Sampling Protocol that was developed as a simple quantitative sampling technique applicable to many vegetation types in California. Investigators use an ocular estimation technique called a releve to classify and map large areas in a limited amount of time.

The releve method of sampling vegetation was developed in Europe and was largely standardized by the Swiss ecologist Josias Braun-Blanquet. He helped classify much of Europe's vegetation, founded and directed a synecology center in France, and was editor of *Vegetation* for many years. The releve was, and is, a method used by many European ecologists, and others around the world. These ecologists refer to themselves as phytosociologists. Use of the releve in the United States has not been extensive with the exception of the U.S. Forest Service.

The releve is particularly useful when observers are trying to quickly classify the range of diversity of plant cover over large units of land. In general, it is faster than the point intercept technique. One would use this method when developing a classification that could be used to map of a large area of vegetation, for example. This method may also be more useful than the line intercept method when one is trying to validate the accuracy of mapping efforts.

The releve is generally considered a "semi-quantitative" method. It relies on ocular estimates of plant cover rather than on counts of the "hits" of a particular species along a transect line. It is less useful, however, when one is attempting to monitor the status of a particular stand of vegetation over time. The point-intersect method previously described by CNPS also was designed to provide data for classification, not monitoring, but can be modified more easily to serve monitoring purposes.

Selecting a stand to sample:

A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small, such as alpine meadow or tundra types, and some may be several square kilometers in size, such as desert or forest types. A stand is defined by two main unifying characteristics:

1) It has compositional integrity. Throughout the site the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or indistinct, and
2) It has structural integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species throughout.

For example, a hillside forest originally dominated by the same species that burned on the upper part of the slopes, but not the lower, would be divided into two stands. Likewise, a sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.

The structural and compositional features of a stand are often combined into a term called homogeneity. For an area of vegetated ground to meet the requirements of a stand it must be homogeneous.

Stands to be sampled may be selected by assessment prior to a site visit (delineated from aerial photos or satellite images for example), or may be selected on site (during reconnaissance to determine extent and boundaries, location of other similar stands, etc.). Depending on the project goals, you may want to select just one or a few representative stands for sampling (e.g., for developing a classification for a vegetation mapping project), or you may want to sample all of them (e.g., to define a rare vegetation type and/or compare site quality between the few remaining stands).

Selecting a plot to sample within in a stand:

Because most stands are large, it is difficult to summarize the species composition, cover, and structure of an entire stand. We are also usually trying to capture the most information with the least amount of effort. Thus, we are typically forced to select a representative portion to sample.

When sampling a vegetation stand, the main point to remember is to select a sample that, in as many ways possible, is representative of that stand. This means that you are not randomly selecting a plot; on the contrary, you are actively using your own best judgment to find a representative example of the stand.

Selecting a plot requires that you see enough of the stand you are sampling to feel comfortable in choosing a representative plot location. Take a brief walk through the stand and look for variations in species composition and in stand structure. In many cases in hilly or mountainous terrain look for a vantage point from which you can get a representative view of the whole stand. Variations in vegetation that are repeated throughout the stand should be included in your plot. Once you assess the variation within the stand, attempt to find an area that captures the stand's common species composition and structural condition to sample.

Plot Size

All releves of the same type of vegetation to be analyzed in a study need to be the same size. It wouldn't be fair, for example, to compare a 100 m2 plot with a 1000 m2 plot as the difference in number of species may be due to the size of the plot, not a difference in the stands.

A minimal area to sample is defined by species/area relationships; as the sampler identifies species present in an area of homogeneous vegetation, the number will increase quickly as more area is surveyed. Plot shape and size are somewhat dependent on the type of vegetation under study. Therefore general guidelines for plot sizes of tree-, shrub-, and herb-dominated upland, and fine-scale herbaceous communities have been established. Sufficient work has been done in temperate vegetation to be confident the following conventions will capture species richness:

Alpine and montane wet meadow communities: 100 sq m
Herbaceous communities: 400 sq m plot
Grasslands and Shrublands: 400 sq m plot
Forest communities: 1000 sq m plot
Open desert vegetation is typically sampled with an even larger plot, a triangular plot 70 meters on a side to yield a 2122 sq m area has been shown to work well.

Plot Shape

A releve has no fixed shape; plot shape should reflect the character of the stand. If the stand is about the same size as a releve, you need to sample the entire stand. If we are sampling a desert wash, streamside riparian, or other linear community our plot dimensions should not go beyond the community's natural ecological boundaries. Thus, a relatively long, narrow plot capturing the vegetation within the stand, but not outside it, would be appropriate. Species present along the edges of the plot that are clearly part of the adjacent stand should be excluded.

If we are sampling broad homogeneous stands, we would most likely choose a shape such as a circle (which has the advantage of the edges being equidistant to the center point) or a square (which can be quickly laid out using perpendicular tapes). If we are trying to capture a minor bit of variety in the understory of a forest, for example a bracken fem patch within a ponderosa pine stand, we would want both bracken and non-bracken understory. Thus, a rectangular shape would be appropriate.

GENERAL PLOT INFORMATION

The following items appear on each data sheet and are to be collected for all plots. Where indicated, refer to attached code sheet.

Releve number: Assigned either in the field or in the office prior to sampling.

Date: Date of sampling.

County: County in which located.

USGS MAP: The name of the USGS map the releve is located on; note series (15' or 7.5').

CNPS Chapter: CNPS chapter, or other organization or agency if source is other than CNPS chapter.

Landowner: Name of landowner or agency acronym if known. Otherwise, list as private.

Contact Person: Name, address, and phone number of individual responsible for data collection.

Observers: Names of individuals assisting. Circle name of recorder.

Elevation: Recorded in feet or meters. Please indicate units.

Slope: Degrees, read from clinometer or compass, or estimated; averaged over releve

Aspect: Degrees from true north (adjust declination), read from a compass or estimated; averaged over releve.

Macrotopography: Characterize the large-scale topographic position of the releve. This is the general position of the sample along major topographic features of the area. *See attached code list.*

Microtopography: Characterize the local relief of the releve. Choose the shape that mimics the lay of the ground along minor topographic features of the area actually within the sample. *See attached code list.*

Legal Description: Township/Range/Section/Quarter Section/Quarter-Quarter section/Meridian: Legal map location of the site; this is useful for determining ownership of the property. California Meridians are Humboldt, Mt. Diablo, or San Bernardino.

Latitude and Longitude: Degrees north latitude and east longitude.

UTMN and UTME: Northing and easting coordinates using the Universal Transverse

Mercator (UTM) grid as delineated on the USGS topographic map; to nearest 0.01 km. See sample map for an example of determining coordinates.

UTM zone: Universal Transverse Mercator zone. Zone 10 for California west of the 120th longitude; zone 11 for California east of 120th longitude.

Community type: Indicate if the sample is in a wetland or an upland; note that a site need not be officially delineated as a wetland to qualify as such in this context.

Dominant vegetation group: This is a four letter code which relates the vegetation of the plot to the higher levels of the NBS/NPS National Vegetation Classification System hierarchy. *See attached code list.*

WETLAND COMMUNITY TYPES

Cowardin class: See *Artificial Keys to Cowardin Systems and Names* (attached). If the plot is located in a wetland, record the proper Cowardin system name. Systems are described in detail in Cowardin et al. (1979) *Classification of Wetlands and Deepwater Habitats of the United States*. US Dept. of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

Marine: habitats exposed to the waves and currents of the open ocean (subtidal and intertidal habitats).

Estuarine: includes deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land (i.e. estuaries and lagoons).

Riverine: includes all wetlands and deepwater habitats contained within a channel, excluding any wetland dominated by trees, shrubs, persistent emergent plants, emergent mosses, or lichens. Channels that contain oceanic-derived salts greater than 0.5% are also excluded.

Lacustrine: Includes wetlands and deepwater habitats with all of the following characteristics: 1) situated in a topographic depression or a dammed river channel; 2) lacking trees or shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and total area exceeds 8 ha (20 acres). Similar areas less than 8 ha are included in the lacustrine system if an active wave-formed or bedrock shoreline feature makes up all or part of the low tideboundary, of if the water in the deepest part of the basin exceeds 2m (6.6 feet) at low tide. Oceanic derived salinity is always less than 0.5%.

Palustrine: Includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity derived from oceanic salts is less than 0.5% . Also included are areas

lacking vegetation, but with all of the following four characteristics: 1) areas less than 8 ha (20 acres); active wave-formed or bedrock shoreline features lacking; 3) water depth in the deepest part of the basin less than 2 m (6.6 feet) at low water; and 4) salinity due to ocean-derived salts less than 0.5%.

Vertical distance from high water mark of active stream channel: If the plot is in or near a wetland community, record to the nearest meter or foot the estimated vertical distance from the middle of the plot to the average water line of the channel, basin, or other body of water.

Horizontal distance from high water mark of active stream channel: If the plot is in or near a wetland community, record to the nearest meter or foot the estimated horizontal distance from the middle of the plot to the average water line of the channel, basin, or other body of water.

Stream channel form: If the plot is located in or near a community along a stream, river, or dry wash, record the channel form of the waterway. The channel form is considered S (single channeled) if it consists of predominately a single primary channel, M (meandering) if it is a meandering channel, and B (braided) if it consists of multiple channels interwoven or braided.

VEGETATION DESCRIPTION

Dominant layer: Indicate whether the community is dominated by the Ground layer (G), Shrubs (S), or Tree (T) layer.

Plant community: Name of series, stand, or habitat according to CNPS classification (Sawyer and Keeler-Wolf 1995).; if the type is not defined by the CNPS classification, note this in the space.

Photo interpreter community code: If the sample is in area for which delineation and photo interpretation has already been done, the code which the photointerpreters applied to the polygon. If the sample site has not been photointerpreted, leave blank.

Other same type polygons (yes or no), if yes, mark on map: Other areas within view that appear to have similar vegetation composition. Again, this is most relevant to areas which have been delineated as polygons on aerial photographs as part of a vegetation mapping project. If one is not working from aerial photographs, draw the areas as on a topographic map.

Adjacent series: Adjacent vegetation series, stands or habitats according to CNPS classification; list in order of most extensive to least extensive.

Vegetation trend: Based on the regenerating species and relationship to surrounding vegetation, characterize the stand as either increasing (expanding), stable, decreasing, fluctuating, or unknown.

Impacts: Enter codes for potential or existing impacts on the stability of the plant community. Characterize each as either 1. Light, 2. Moderate, of 3. Heavy. *See attached code list.*

Structure: Characterize the structure of each layer.

> Continuous = greater than 2/3 (67%) cover; crowns touching
> Intermittent = between 1/3 and 2/3 cover (33% to 66 %); interlocking or touching crowns interrupted by openings.
> Open = less than 1/3 (33%) cover; crowns not touching or infrequently touching.

Phenology: Based on the vegetative condition of he principal species, characterize the phenology of each layer as either early (E), peak (P), or late (L).

Plot shape: indicate the sample shape as : square, rectangle, circle, or the entire stand. Plot

Size: length of rectangle edges, circle radius, or size of entire stand.

> NOTE: See page 3.
> Alpine and montane wet meadow communities: 100 sq. m
> All intermittent to dense shrub and herb plots: 400 sq.m
> All forest and woodland plots: 1000 sq m.
> All open desert plots 1000 sq. m

COARSE FRAGMENTS AND SOIL INFORMATION

Coarse fragments, litter: Estimate the cover class of each size at or near the ground surface averaged over the plot. Always remember to estimate what you actually see on the surface as opposed to what you think is hiding under vegetation, organic litter, etc.

> Bedrock: continuous, exposed, non-transported rock Gravel: rounded and
>
> angular fragments >0.125, < 3 inches diameter Cobble: rounded and
>
> angular fragments 3-10 inches in diameter Stone: rounded and angular
>
> coarse fragments > 10 inches in diameter
>
> Litter: extent of undecomposed litter on surface of plot (this includes all organic matter, e.g. fallen logs, branches, and twigs down to needles and leaves).

Soil texture: Record the texture of the upper soil horizon, below the organic layer if one is present. *See attached key and code list.*

Parent Material: Geological parent material of site. *See attached code list.*

Site location and description: A careful description that makes revisiting the vegetation stand and plots possible; give landmarks and directions. Indicate on a photocopy of a USGS topographic map (preferably 7.5') and attach to field survey form. If possible, draw a boundary around the patch on the map. It is also helpful to briefly describe the topography, aspect, and vegetation structure of the site.

Photographs: Describe view direction from compass bearings, or estimates of color slides taken at the releve. It is helpful to take a photograph of the releve from the intersection of the tapes, (if tapes were used to define the plot), and another from inside the releve. Additional photographs of the stand may also be helpful. Also note the roll number, frame number, and name of the person whose camera is being used.

Site history: Briefly describe the history of the stand, including type and year of disturbance (e.g. fire, landslides or avalanching, drought, flood, or pest outbreak). Also note the nature and extent of land use such as grazing, timber harvest, or mining.

Unknown plant specimens: List the numbers of any unknown plant specimens, noting any information such as family or genus (if known), important characters, and whether or not there is adequate material for identification. Do not take samples of plants of which there are only a few individuals or which you think may be rare. Document these plants with photographs.

Additional comments: Feel free to note any additional observations of the site, or deviations from the standard sampling protocol. If additional data were recorded, e.g. if tree diameters were measured, please indicate so here.

VEGETATION DATA

Assessment of Layers

This first step is described in the CNPS point-intercept transect protocol. Estimates the maximum height for the ground and shrub layers and the minimum height for the tree layer are recorded. These estimates are made after a quick assessment of the vegetation and its structure. The estimates need not be overly precise and will vary among vegetation types. A caveat: if several releves are being sampled within the same vegetation type, it is important to be consistent when assigning layers. Some types will have more than three layers (e.g. two tree layers of different maximum height); this should be indicated in the releve description. However, data are recorded for only three layers (ground, shrub, and tree). The layer a species occupies will often be determined by growth form, but exceptions do occur. For example, with trees young seedlings may occupy the ground layer, saplings the shrub layer, and mature individuals the tree layer for some taxa, for example.

Species List

The collection of vegetation data continues with making a comprehensive species list of all vascular plants within the releve. This list is achieved by meandering through the plot to see all microhabitats. During list development, observers document each taxon present in each layer in which it occurs separately, recording it on a different line of the data form and noting which layer is represented. This is important for data entry because each layer of each represented taxon will be entered separately. Each individual plant is recorded in only one layer, the layer in which the tallest portion of the individual is found. One should reach a point at which new taxa are added to the list only very slowly, or sporadically. When one has reached that point, the list is probably done.

The following sections explain how to perform the actual releve, the Estimation of Cover Values. The sections prefaced by bold-faced titles explain the technique, the sections with regular font titles refer to the steps needed to complete the accompanying Field Form.

Estimating Cover:

There are many ways to estimate cover. Many people who have been in the cover estimation "business" for a long time can do so quickly and confidently without any props and devices. However, to a novice, it may seem incomprehensible and foolhardy to stand in a meadow of 50 different species of plants and systematically be able to list by cover value each one without actually "measuring" them in some way.

Of course, our minds make thousands of estimates of various types every week. We trust that estimating plant cover can be done by anyone with an open mind and an "eye for nature." It's just another technique to learn.

It is very helpful to work initially with other people who know and are learning the technique. In such a group setting, typically a set of justifications for each person's estimate is made and a "meeting of the minds" is reached. This consensus approach and the concomitant calibration of each person's internal scales is a very important part of the training for any cover estimate project.

An underlying point to remember is that estimates must provide some level of reliable values that are within acceptable bounds of accuracy. If we require an accuracy level that is beyond the realm of possibility, we will soon reject the method for one more quantitative and repeatable. As with any scientific measurement, the requirement for accuracy in the vegetation data is closely related to the accuracy of the information needed to provide a useful summary of it. Put into more immediate perspective - **to allow useful and repeatable analysis of vegetation data, one does not need to estimate down to the exact percent value the cover of a given plant species in a given stand.**

This point relates to two facts: there is inherent variability of species cover in any

environment. For example, you would not expect to always have 23% *Pinus ponderosa*, 14% *Calocedrus decurrens*, and 11% *Pinus lambertiana* over an understory of 40% *Chamaebatia foliosa*, 3% *Clarkia unguiculata*, and 5% *Galium bolanderi* to define the Ponderosa pine-Incense cedar/mountain misery/Bolander bedstraw plant community. Anyone who has looked at plant composition with a discerning eye can see that plants don't space themselves in an environment by such precise rules. Thus, we can safely estimate the representation of species in a stand by relatively broad cover classes (such as <1%, 1-5 %, 5-25%, etc.) rather than precise percentages.

The data analysis we commonly use to classify vegetation into different associations and series (TWINSPAN and various cluster analysis programs, for example) is likewise forgiving. When analyzed by quantitative mutivariate statistics information on species cover responds to coarse differences in cover and presence and absence of species, but not to subtle percentage point differences. This has been proven time and again through quantitative analysis of vegetation classification. Many of the world's plant ecologists estimate cover rather than measure it precisely. Some of the seminal works in vegetation ecology have been based on cover estimates taken by discerning eyes.

With this as a preamble, below we offer some suggestions on estimating cover that have proven helpful. These are simply "tricks" to facilitate estimation, some work better for different situations. You may come up with other methods of estimation that may seem more intuitive, and are equally reliable in certain settings. All values on the releve protocol that require a cover class estimate, including coarse fragment and vegetation layer information, may rely on these techniques. Just make the appropriate substitutions (using the coarse fragment example substitute, bedrock, stone, cobbles, gravel, and litter for vegetation).

Method 1: The invisible point-intercept transect:

This method works well in relatively low, open vegetation types such as grasslands and scrubs where you can see over the major stand components. For those who have worked with the original CNPS line intercept methodology it's like counting hits along an imaginary line at regular intervals of the 50 m tape. Here's how it goes:

> Envision an imaginary transect line starting from your vantage point and running for 50 m (or however many meters you wish, as long as you are still ending up within the same stand of vegetation you're sampling - never keep counting outside of your homogeneous stand). Now "walk" your eye along this tape for 50 m and visually "take a point" every 0.5 m. Don't worry about precision, just try to "walk" your eye along the line and stop every 0.5 m or at any other regular interval until you reach its end and mentally tally what species you hit. Once you come up with a number of hits for each major species in one imaginary transect, take another transect in another direction and estimate the number of hits on that one. Do this several times (usually 3-4 is enough if you are in a homogeneous stand), then average your results.
>
> This can go quickly in simple environments and in environments where the major

species are easily discernable (chaparral, bunch-grassland, coastal scrub, desert scrub). Your average number of hits need not be a total of 100 as in the original transect method, but could be 50 along a 25 m imaginary line (in which case you would multiply by two to get your estimated cover), or 25 along a 12.5 m line (multiply average by 4), etc.

Method 2: Subdivision of sample plot into quadrants:

Many plots, whether they are square, circular, or rectangular, may be "quartered" and have each quadrant's plant cover estimated separately. If the plot is a given even number of square meters (such as 100, 400, or 1000 sq. m) then you know that a quarter of that amount is also an easily measurable number. If you can estimate the average size of the plants in each of the quarters (e.g., small pinyon pines may be 5 m5 (2.2m x 2.2m), creosote bush may be 2m5 (or 1.14 m x 1.14m), burrobush may be 0.5m5) then you simply count the number of plants in each size class and multiply by their estimated size for the cover in a given quadrant. Then you average the 4 quadrants together for your average cover value.

This method works well in vegetation with a dense cover of low species such as grasses or low shrubs, in open woodlands, and desert scrubs.

Method 3; "Squash" all plants into a continuous cover in one corner of the plot: Another way to estimate how much of the plot is covered by a particular species is to mentally group (or "march", or "squash") all members of that species into a corner of the plot and estimate the area they cover. Then calculate that area as a percentage of the total plot area. This technique works well in herb and shrub dominated plots but is not very useful in areas with trees.

Method 4: How to estimate tree cover:

Cover estimates of tall trees is one of the most difficult tasks for a beginning releve sampler. However it is possible to do this with consistency and reliability using the following guidelines.

1. Have regular sized and shaped plots that you can easily subdivide.
2. Estimate average crown spread of each tree species separately by pacing the crown diameter of representative examples of trees of each species and then roughly calculating the crown area of each representative species.
3. Add together the estimated crown area of each individual of each species of tree on the plot for your total cover.

Method 5: The process of elimination technique:

This method is generally good for estimating cover on sparsely vegetated areas where bare ground, rocks, or cobbles cover more area than vegetation. In such a situation it would be advisable to first estimate how much of the ground is not covered by plants and then subdivide the portion that is covered by plants into rough percentages proportional to the different plant species present. For example, in a desert scrub the total plot not covered by plants may be estimated at 80%. Of the 20% covered by plants, half

is desert sunflower (10% cover), a quarter is California buckwheat (5% cover), an eighth brittlebush (2.5% cover), and the rest divided up between 10 species of herbs and small shrubs (all less than 1% cover).

Any of these techniques may be used in combination with one another for a system of checks and balances, or in stands that have characteristics lending themselves for a different technique for each layer of vegetation.

In a releve, cover estimates, using the techniques described above, are made for each taxon as it is recorded on the species list. Estimates are made for each layer in which the taxon was recorded. For example, if individuals of coast live oak occur in the tree, the shrub, and the ground layer, an estimate is made for Tree CLO, for Shrub CLO, and for Ground CLO.

In a traditional releve, cover is estimated in D cover classes, D not percentages, because of the variability of plant populations over time and from one point to another, even within a small stand. This protocol uses the following 6 cover classes:

Cover Class 1: the taxon in that layer covers < 1 % of the plot area Cover
Class 2: the taxon in that layer covers >1% - 5% of the plot area Cover
Class 3: the taxon in that layer covers >5 - 25 % of the plot area Cover
Class 4: the taxon in that layer covers >25 - 50 % of the plot area Cover
Class 5: the taxon in that layer covers >50 -75 % of the plot area Cover
Class 6: the taxon in that layer covers > 75% of the plot area

Percentages (optional)

This CNPS protocol also encourages observers to estimate percentages if they feel confident in their estimation abilities. This optional step allows the data to be compared more easily to data collected using different methods, such as a line or point intercept. It also instills confidence in the cover estimate of borderline species that are close calls between two cover classes (e.g., a cover class 2 at 5% as opposed to a cover class 3 at

Total Vegetation Cover

In addition to cover of individual taxa described above, total cover is also estimated by vegetation layer. This is done using the same cover classes as described above but combines all taxa of a given layer. This can be calculated from the species estimates but if one does it independently, and comes up with the same cover class estimate, it is very satisfying.

National Biological Survey height Classes for Vegetation Strata

The releve method just described calls for estimates of plant cover for each taxon. It is strongly floristically oriented. Another way of considering the relationships between

plants in vegetation is by evaluating structure, or physiognomy. The underlying thinking is that life forms within a stand of vegetation occur in response to similar ecological pressures (TNC 1994). Estimation of cover within predetermined height classes is one way to describe the structure of vegetation. Structure of a stand of vegetation also is used in modeling wildlife use of the vegetation (WHR).

For information gathered using this CNPS protocol to be comparable with the wealth of information being gathered by the National Park Service and the Biological Resources Division (BRD) of the USGS it is also necessary for CNPS to estimate vegetation cover according to pre-defined vegetation strata. The following Height classes are defined by the NPS :

High Tree	>30 m.
Medium High Tree	20-30 m.
Medium Low Tree	10-20 m.
Low Tree	5-10 m.
High Shrub	2-5 m
High Herb/ Medium Shrub	1 -2 m.
Low Shrub	0.5-1 m
Medium Herb	25-50 cm.
Low Herb	0-25 cm.
Moss/Lichen	

Cover in these vegetation strata is estimated using the same cover classes as were used for cover of individual taxa. Again, estimation of percentages is optional. Please note that although these strata have names, they don't necessarily have to be populated by the type of species that are their namesake (e.g., tall herbaceous species may be diagnostic of the tall shrub category in the case of a giant reed stand).

Caveats:

Please consult with the members of the vegetation committee for advice and feedback on proposed vegetation surveys prior on initiating projects.

References:

Barbour M.G., J.H. Burk, and W.D. Pitts (1987) *Terrestrial Plant Ecology, Second Edition.* Benjamin/Cummings Publishing Co. Menlo Park, CA. 634 pages.

Sawyer and Keeler-Wolf (1995) *A Manual of California Vegetation*. California Native

Plant Society, Sacramento, CA.. 471 pages

The Nature Conservancy and Environmental Systems Research Institute (1994) *Final Draft, Standardized National Vegetation Classification System*. Prepared for United States Department of the Interior, National Biological Survey, and National Park Service. Arlington, VA. Complete document available at the following website: http||:biology.usgs.gov/npsveg/fieldmethods.html

CALIFORNIA NATIVE PLANT SOCIETY RELEVÉ FIELD FORM

(Revised 10/12/00)

See code list for italicized fields

	FOR OFFICE USE ONLY
Polygon #_____ Relevé # _____	Permanent Number:
Date: _____/ _____/ _____ DD MMM YY	Community Name: Community Number: Occurrence Number:
County:	Source Code:
USGS Quad. 7.5 or 15' (Circle one)	Quad Code: Quad Name: Map Index Number:
CNPS Chapter:	Update: Yes No (Circle one)

Landowner:

Contact Person:

Address:

City:	Zip:	Phone number:

Observers:

Elevation (ft.)_____ Slope (°) _____Aspect (°) _____ Topography: *Macro* _____ *Micro* _____

GPS File # _____ GPS points in file _____ Start Time _____:_____(am or pm) GPS Datum (from GPS setup) (UTM, NAD 27, NAD 83, etc.) _____

File Type: Point or Polygon (circle one) UTMN _____ UTME _____ UTM Zone _____

Vegetation Description

Dominant Layer: 0- 0. 5 m __ >0.5-4 m__, >4 m__Preliminary Alliance Name _____ Photo Interpreter Community Code for Polygon_____
(low, mid, tall)

Community Type: _____ *Dominant Vegetation Form:* _____
(Wetland or Upland) (use codes from code list)

If Community Type=Wetland (see Artificial Keys to Cowardin Systems and Names)

Cowardin System _____ Subsystem _____ Class _____

Distance to water (m): Vertical _____ Horizontal _____ Channel form (if riverine) _____
(Straight, Meandering, Braided)

Adjacent Vegetation: Location (e.g., North, south, east west of stand)	Description (up to 4 species by layer)

Trend code _____
1. Increasing 2. Stable 3. Decreasing
4. Fluctuating 5. Unknown

Impact codes _____ _____ _____ _____ _____ _____ _____ _____
(List codes in order, with most significant first)

Intensity _____ _____ _____ _____ _____ _____ _____ _____
1. Light 2. Moderate 3. Heavy (List beneath each impact code)

Site Location and Plot Description

Site History – *including observations of fire scars, insect/disease damage, grazing/browsing, human disturbance*

Photographs – *Note position and direction of photo(s) relative to plot*

Sensitive Species – *List species observed and GPS UTM's Estimate size and extent of local populations*

Unknown Specimens *List code, identification notes (e.g. Genus, condition of specimen) of unknowns*

Additional Comments – *Including animal observations, anthropological observations, abiotic features*

Height Classes for Vegetation Strata & Cover Estimates (see cover class intervals-**below** ⇓)

Layer name:	Cryptogam Layer	0-25 cm.	25-50 cm.	0.5-1m.	1-2 m.	2-5 m.	5-10m.	10-20 m.	20-30 m.	>30 m.
Diagnostic species										
Cover class:										

Cover Class Intervals: 1 (<1%), 2 (1-5%), 3a (>5-15%), 3b (>15-25%), 4 (>25-50%), 5 (>50-75%), 6 (>75%)

SurfaceCoarse fragments and soils information (see cover class intervals-**above** ⇑)

Total Vegetation Cover (Class): _____ Total Tall_____ Total Medium _____ Total Low _____ Total Non-Native _____

percent cover of above: _____ _____ _____ _____ _____

*note all surface fragments and non vegetation should add up to 100%

CALIFORNIA NATIVE PLANT SOCIETY
CALIFORNIA PLANT COMMUNITIES RELEVÉ FIELD FORM (PART 2)
SPECIES TALLY SHEET
(Revised 10/20/00)
Page_____ of releve # _____

Cover Class Intervals: 1 (<1%), 2 (1-5%), 3a (>5-15%), 3b (>15-25%), 4 (>25-50%), 5 (>50-75%), 6 (>75%)

L=Low herbs and subshrubs (<0.5 m.), M=Medium height (0.5 m.-4.0 m.), Tall Plants= (>4.0 m.)

L	M	T	Vascular plant name or moss/lichen cryptogamic crust cover	Final species determination	Cover Class	%
			Litter (from previous sheet)			
			Bare Ground (all non-vegetated and non-litter)			

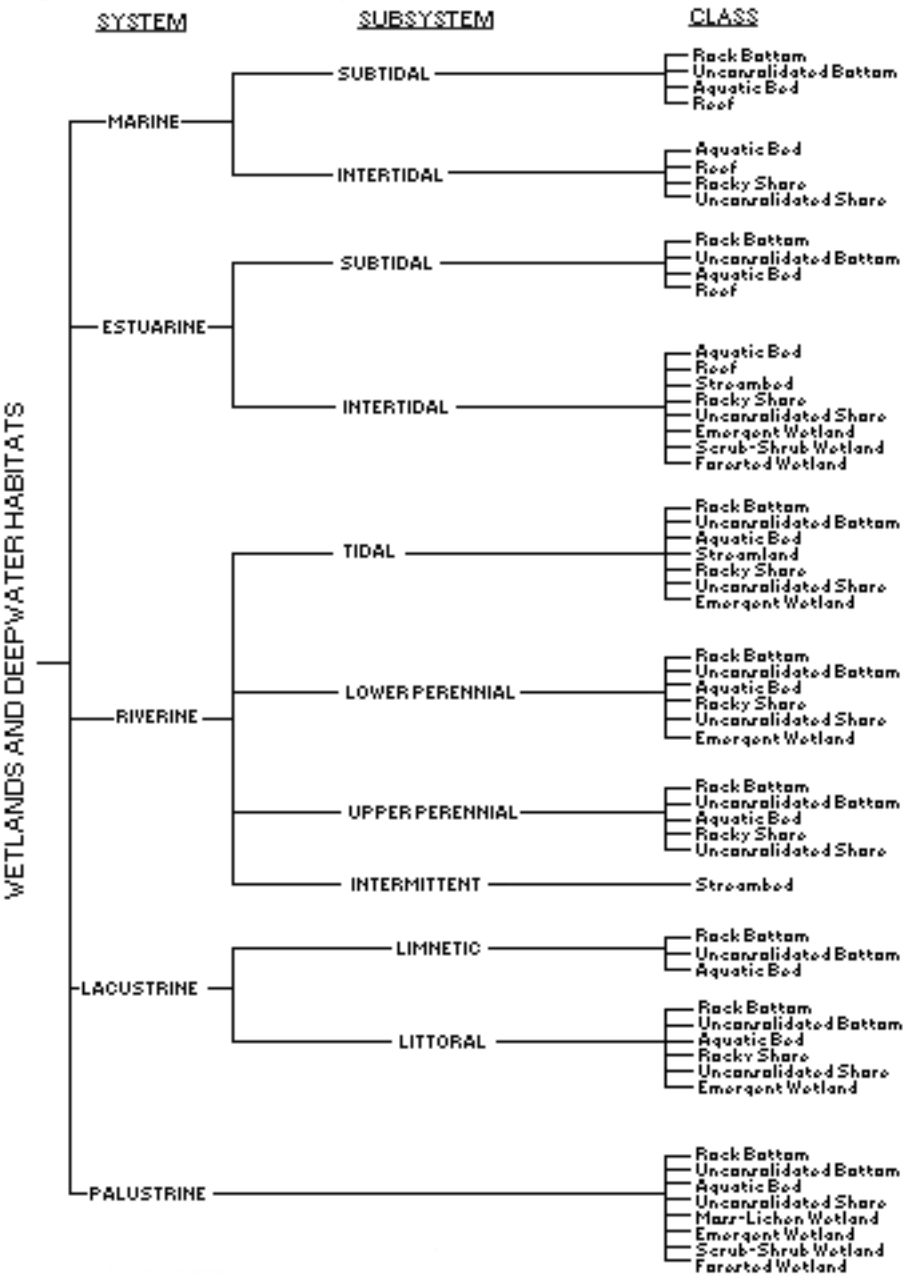

Fig. 1. Classification hierarchy of wetlands and deepwater habitats, showing Systems, Subsystems, and Classes. The Palustrine System does not include deepwater habitats.

Artificial Key to the Systems and Classes

Key to the Systems

1. Water regime influenced by oceanic tides, and salinity due to ocean-derived salts 0.5% or greater.
    2. Semi-enclosed by land, but with open, partly obstructed or sporadic access to the ocean. Halinity wide-ranging because of evaporation or mixing of seawater with runoff from land . . . . . ESTUARINE
    2'. Little or no obstruction to open ocean present. Halinity usually euhaline; little mixing of water with runoff from land 3
        3. Emergents, trees, or shrubs present . . . . . ESTUARINE
        3'. Emergents, trees, or shrubs absent. . . . . MARINE
1'. Water regime not influenced by ocean tides, or if influenced by oceanic tides, salinity less than 0.5%
    4. Persistent emergents, trees, shrubs, or emergent mosses cover 30% or more of the area . . . . . PALUSTRINE
    4'. Persistent emergents, trees, shrubs, or emergent mosses cover less than 30% of substrate but nonpersistent emergents may be widespread during some seasons of year 5
        5. Situated in a channel; water, when present, usually flowing . . . . . RIVERINE
        5'. Situated in a basin, catchment, or on level or sloping ground; water usually not flowing. 6
            6. Area 8 ha (20 acres) or greater . . . . . LACUSTRINE
            6'. Area less than 8 ha 7
                7. Wave-formed or bedrock shoreline feature present or water depth 2 m (6.6 feet) or more . . . . . LACUSTRINE
                7'. No wave-formed or bedrock shoreline feature present and water > 2 m deep . . . . . PALUSTRINE

Key to the Classes

1. During the growing season of most years, aerial cover by vegetation is less than 30%.
    2. Substrate a ridge or mound formed by colonization of sedentary invertebrates (corals, oysters, tube worms) . . . . . REEF
    2'. Substrate of rock or various-sized sediments often occupied by invertebrates but not formed by colonization of sedentary invertebrates 3
        3. Water regime subtidal, permanently flooded, intermittently exposed, or semipermanently flooded. Substrate usually not soil 4
            4. Substrate of bedrock, boulders, or stones occurring singly or in combination covers 75% or more of the area . . . . . ROCK BOTTOM
            4'. Substrate of organic material, mud, sand, gravel, or cobbles with less than 75% areal cover of stones, boulders, or bedrock. . . . . UNCONSOLIDATED BOTTOM
        3'. Water regime irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded. Substrate often a soil 5
            5. Contained within a channel that does not have permanent flowing water (i.e., Intermittent Subsystem of Riverine System or Intertidal Subsystem of Estuarine System) . . . . . STREAMBED
            5'. Contained in a channel with perennial water or not contained in a channel 6
                6. Substrate of bedrock, boulders, or stones occurring singly or in combination covers 75% or more of the area . . . . . .ROCKY SHORE
                6'. Substrate of organic material, mud, sand, gravel, or cobbles; with less than 75% of the cover consisting of stones, boulders, or bedrock. . . . . UNCONSOLIDATED SHORE
1'. During the growing season of most years, percentage of area covered by vegetation 30% or greater.
    7. Vegetation composed of pioneering annuals or seedling perennials, often not hydrophytes, occurring only at time of substrate exposure 8
        8. Contained within a channel that does not have permanent flowing water. . . . . STREAMBED (VEGETATED)
        8'. Contained within a channel with permanent water, or not contained in a channel . . . . . UNCONSOLIDATED SHORE (VEGETATED)
    7'. Vegetation composed of algae, bryophytes, lichens, or vascular plants that are usually hydrophytic perennials 9
        9. Vegetation composed predominantly of nonvascular species 10
            10. Vegetation macrophytic algae, mosses, or lichens growing in water or the splash zone of shores . . . . . AQUATIC BED
            10'. Vegetation mosses or lichens usually growing on organic soils and always outside the splash zone of shores . . . . . .MOSS-LICHEN WETLAND
        9'. Vegetation composed predominantly of vascular species 11
            11. Vegetation herbaceous 12
                12. Vegetation emergents. . . . . .EMERGENT WETLAND
                12'. Vegetation submergent, floating-leaved, or floating. . . . . .AQUATIC BED
            11'. Vegetation trees or shrubs 13
                13. Dominants less than 6 m (20 feet) tall . . . . . .SCRUB-SHRUB WETLAND
                13'. Dominants 6 m tall or taller . . . . . .FORESTED WETLAND