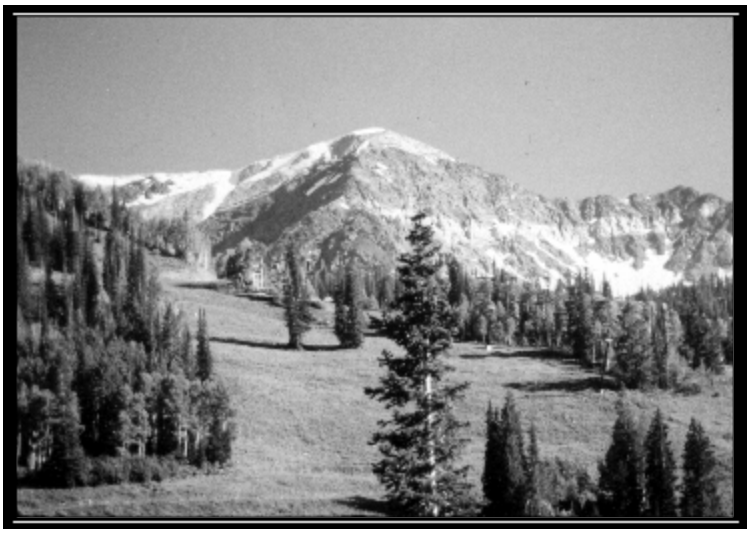
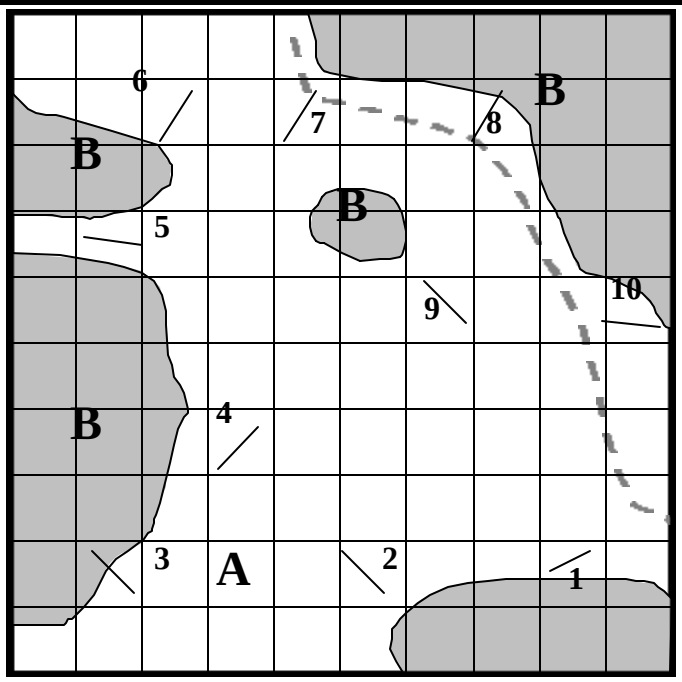
Monitoring Avian Productivity and Survivorship (MAPS)

Habitat Structure Assessment (HSA) Protocol:

describing vertical and horizontal spatial habitat patterns at MAPS stations





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ACKNOWLEDGEMENTS

We thank the DOD Legacy Resources Management Program, USDA Forest Service, National Park Service, U.S. Fish and Wildlife Service Division of Migratory Bird Management, USGS Biological Resources Division, and National Fish and Wildlife Foundation for funding to create this protocol. We thank former MAPS biologists Ken Burton and Dan Froehlich for their efforts designing earlier habitat protocols that led to this Habitat Structure Assessment Protocol, and MAPS biologists Amy McAndrews, Danielle O'Grady, Pilar Velez, and Kerry Wilcox for their advice and input. We also would like to thank Ken Heselton for the use of his HSA data and station map in this Manual. Finally, our thanks go out to the multitude of MAPS contributors who have used the HSA and preceding habitat protocols and who have provided invaluable feedback and advice.

Reference Citation:
Nott, P., D.F. DeSante, and N. Michel. 2003. Monitoring Avian Productivity and Survivorship (MAPS) Habitat Structure Assessment (HSA) Protocol.
The Institute for Bird Populations, Pt. Reyes Station, CA.

This is Contribution Number 128 of the Institute for Bird Populations.

Table of Contents

Descriptions of Figures

HSA Forms

Appendices

Introduction

The Monitoring Avian Productivity and Survivorship (MAPS) program is focused on monitoring avian demographic parameters and relating their spatial and temporal variation to landscape-scale ecological and environmental data. For this purpose we utilize geographic information systems (GIS), remote sensing of habitat types, and existing vegetation maps from various sources, at a variety of spatial resolutions (e.g., from 1km to 30m cells). Unfortunately, these kinds of spatial data are often very coarse. For instance, the 30m resolution Multi-Resolution Land Cover (MRLC) database can provide general categories of habitat type (e.g., deciduous forest, shrubland) but no information regarding the specific plant communities and vertical structure of the vegetation associated with the habitat types.

The horizontal pattern, vertical structure, and type of the vegetation within a MAPS station can affect the number and diversity of breeding birds present, as well as the efficiency with which birds can be monitored by mist-netting. Many ecological studies show that habitat structure is an important factor for predicting avian diversity and abundance. It has been shown, in general, that spatial habitat patterns and vertical habitat structure are good predictors of the presence and relative demographic success of component species in avian communities. Furthermore, changes in the vegetation at a station may cause changes in the breeding bird community or affect how attractive the site is to dispersing birds. For all these reasons, the Habitat Structure Assessment (HSA) protocol is designed to describe the type and distribution of the vegetation at each monitoring station in each year.

The types of vegetation at a MAPS station are classified using plant alliances described by a federally accepted standard (National Vegetation Classification Standard, 1997,Vegetation Subcommittee, Federal Geographic Data Committee). The HSA protocol provides an on-ground assessment of the vegetation type and structure (similar to, but more detailed than the NVCS data collection form), which can be compared to remotely sensed spatial vegetation data. In addition, the protocol provides us with fine-resolution data, such as the vertical structure of a forested patch or the presence of small ponds, that may be undetectable by remote methods.

MAPS banding data can be combined with remotely sensed datasets, habitat structure assessment data, breeding status lists (BSL), breeding/overwintering range data, and various weather and other environmental data to tackle some aspects of avian population conservation. Analyses of these data will help guide efforts towards the ultimate goal of providing management solutions to the problems of declining avian populations, and to make these solutions available to a variety of land stewards. The success of this approach will depend in large measure upon the participation of station operators in applying the HSA protocol.

Habitat Structure Assessment (HSA)

The Habitat Structure Assessment protocol is designed to describe the horizontal and vertical structure of the habitat type(s) present at a MAPS station. The goal is to describe the arrangement and coverage of up to five (but normally two) discrete and recognizable habitat types at your station and, within each of those habitat types, to describe the arrangement and coverage of component vertical layers. We provide a pictorial guide to a number of spatial arrangements of patches to help you in this task and a blank grid map to help you map and classify the main habitat types within your station.

The methods outlined in these instructions are designed to provide useful information with a minimum of effort. Please keep in mind that the purposes of these maps and descriptions are:

a) to provide a general classification and characterization of the habitat of the study area to allow for broad comparisons and groupings among stations;
b) to provide a method for monitoring major changes in the vegetation that occur as a result of natural successional change, new management practices (logging, grazing, development), or the occurrence of major "catastrophes" such as fire or flood; and
c) to provide a relatively rapid assessment of the habitat structure and spatial patterns of vegetation.

Once the results of these assessments are analyzed, we will be able to group stations in terms of features to which a chosen target species may respond. Then we can investigate in more detail, using remotely sensed imagery and ground-truthed vegetation maps, the landscape-level (within 10km of station) spatial habitat patterns associated with stations belonging to those groups. In this way we hope to identify the landscape patterns associated with high population levels and high productivity indices of target species. We can then suggest management actions to achieve similar spatial habitat patterns in areas with lower population levels and lower productivity. This combination of monitoring population demographics, ecosystem modeling, population modeling, and management action provides the basis for an adaptive management approach at the community or ecosystem level.

Beginning in the 2002 field season, Habitat Structure Assessments no longer need to be conducted yearly. Instead, complete **Habitat Structure Assessments should be conducted every five years, unless the habitat at the station has undergone a major change** (e.g., fire, hurricane, logging, construction, brush-clearing, etc.). We do ask that contributors take a copy of their station map and competed HSA forms into the field each year at the appropriate time (see below) and verify that the information is correct, and has not significantly changed. These vegetation assessments, both complete HSA's and yearly verifications, should be made during the **fourth period of recommended operation** (usually the time of maximum canopy and shrub cover).

It may be helpful to follow the step-by-step approach to preparing your station map and habitat description(s) as outlined on the following pages.

A Step-by-Step Approach to the MAPS Habitat Structure Assessment

Step1: Prepare a station map. The station map should depict the locations of your nets and the major physical features of the study area. A typical MAPS station consists of about ten 12-m mist nets dispersed rather uniformly over an 8-hectare (20-acre) core area. Plot the exact location,

orientation, and designation (net number) of each of your nets in the central portion of a copy of the 24 x 24 cell grid map (Form H0: MAPS Station Map) provided in the HSA protocol. The scale of each cell on this map should normally be 30m on a side. If your station is very long you might need to increase the size of a map cell from the standard 30m to perhaps 40m. If your station is very small (because you have your nets spaced closely together; see below), you might need to decrease the size of a map cell down to 20m. Be sure to indicate the scale on your station map by using the scale bar provided. In addition, plot also the exact locations of all the important natural and human-made physical features such as lakes, ponds, streams, ditches, roads, trails, buildings, and other structures. Be sure also to indicate magnetic north on your map. If possible, obtain an aerial photograph or GIS output of the site, use it to help locate the nets and other physical features on your station map, and submit it to IBP *in addition* to the station map. It is important to mark clearly the **exact location and orientation** of each net on the station map. This will assure that the location and orientation of individual nets will remain consistent if the personnel operating a station changes from year to year.

Step 2: Identify the boundary of your station and draw it on the station map. The boundary of a MAPS station is defined to include all areas that lie within 100m of the outermost nets. Remember, 100m is equal to over eight standard (12m) net lengths; you may be surprised at how much area this encompasses! On the map, however, 100m is a distance equivalent to three and one-third cells on the 30m grid (see heavy dashed line on Figure 1). The station boundary itself can be determined by first drawing a circle with radius equal to 100m centered at the outermost end of each net. This should produce a set of overlapping circles. Then connect the outermost points of the outermost circles with a smooth, straight or slightly outwardly convex line. This will give you the boundaries of your station. If you have nets that are more than 200m removed from all other nets (producing non-overlapping circles), a corridor about 100m wide between these nets and encompassing the route traveled to reach them should be included within the station boundary. In this way, all stations will be single units regardless of layout of their nets.

Note that, in general, this procedure will create an approximately 20 hectare (50 acre) station if ten nets are dispersed over an 8-hectare (20-acre) core area. In the ideal case, the periphery of the 8-hectare core area would approximately be a square 280m on a side or a 160m radius circle, while the boundary of the 20-hectare station would approximately be a square 450m on a side or a 250m radius circle. When plotted on the 30m grid map, such stations will encompass about 225 squares (a grid of 15 x 15 cells for a square station). The shape of your station, however, may not be a square or a circle. Nets, for example, might be located along a riparian corridor, within and around a montane meadow, or around part of an ox-bow lake. To allow you to map variously shaped stations, Form H0 depicts a 24 x 24 cell grid. In general you should try to include between about 200 and 250 cells in your station. Even if your station is long and narrow, it should be drawn at least eight squares wide; a map using a grid of 9 x 24 cells might be ideal for such a case. Figure 1 presents an example of a completed station map. This example is based on an actual map submitted to us by Ken Heselton. Note that the nets are clustered somewhat more closely than normal for a typical MAPS station and, as a result, the total area of the station is only about 13 hectares (rather than 20 hectares).

Step 3: Define and delineate the habitats within the station. Habitat definitions should be based primarily on vegetation type and structure, and hydrology. Generally, anything smaller than about one ha (about 2.5 acres) in area - roughly equivalent to about ten or eleven 30m grid cells - should not be considered a separate habitat. Water features, such as lakes or rivers, should ***not*** be considered a

separate habitat, regardless of size. Consider also the bird communities present in deciding whether to define and delineate separate habitats; different habitats should be reflected in some way in the bird communities they support. However, do not define your habitats too narrowly; if you wind up with more than five, you must reconsider your definitions. ***Typically, stations have one, two or three habitat types; only rarely are there more, so do not feel obliged to recognize five habitat types.***

Provide a concise name for each habitat type you identify within your station. In addition, use the National Vegetation Classification Standard (1997) provided in Appendices 1-6 to identify each habitat type to the **ALLIANCE** level (see below under 'National Vegetation Classification Standard Alliance'). Please ensure that **no two habitat types present within your station have the same alliance code.** For example, consider a station in the Sierra Nevada that encompasses coniferous forest surrounding a meadow featuring extensive willow thickets that in total cover just over one hectare and a patch of black oak woodland covering two hectares.

The forested area may contain two major tree species with some sort of delineation; let us say *Pinus contorta* (lodgepole pine) forest is more dominant near the edge of the montane meadow but *Abies magnifica* (red fir) forest dominates the interior. In this case, the coniferous forest should be treated as two habitat types since *Pinus contorta* forest and *Abies magnifica* forest can be separated spatially and represent different alliances (from Appendix 4, page 1: IA8Nc26 and IA8Nb4, respectively). The *Quercus Kelloggii* (black oak) woodland is obviously a separate alliance (from Appendix 4, page 2: IIC2Na4).

Similarly, you would classify the *Salix sp*. (willow) thickets (from Appendix 4, page 5: IIIB2Nd30 - 39) as a different habitat type from the montane meadow. It is also possible that in managed areas there will be distinct patches of, for instance, woodland or forest almost entirely dominated by different tree species; we suggest that these be treated as separate habitats. A mature *Pinus contorta* plantation would be defined by the NVCS as alliance IA8Cc26 (the C for "Planted/Cultivated" replaces the N for "Natural/Semi-natural", see above and Appendix 2). These patches of different forest will likely be of different ages and under different management regimes with respect to fire and harvesting. This will affect the structure and composition of the plant communities that occur within them and, in turn, will affect the composition of the avian communities that utilize them.

Clearly indicate the habitat delineations on your station map by drawing solid lines around them and shading the area if necessary. However, do not let your shading mask the clarity of net locations and other physical features. Indicate on your map the date that you finalized your habitat delineation.

Step 4: Establish the dominance class of the main habitat types within your station. Identify up to five main habitat types and determine their relative dominance within your station boundaries:

Dominant - the dominant habitat is the one occupying the largest proportion of the station (regardless of where nets are located). This should correspond to Habitat Code A.

Subdominant - the subdominant habitat is the one occupying the second largest proportion of the station. This should correspond to Habitat Code B.

Minor - minor habitats are those occupying proportions of the station less than or equal to that of the subdominant habitat. You may define up to three minor habitat types corresponding to Habitat Codes C, D and E. Remember that minor habitats must cover at least one hectare

(or at least 5% of the area of a typical station). In general, defining a second or third minor habitat type is rarely required. Aim for the fewest number that well represents the station.

Example: Your station consists of a small meadow dotted with willow thickets surrounded by forest, and a small stream runs through the middle of the meadow. In this case ***forest*** is the dominant habitat (A), even if all the nets are within the meadow. ***Grassland/meadow*** represents the subdominant habitat (B), and ***willow shrubland*** represents a minor habitat (C). Similarly, a narrow, wooded draw in a prairie would be a subdominant ***woodland*** habitat; the prairie is the dominant ***grassland/meadow*** habitat, even if all the nets are in the draw. Marshy areas also may represent a minor type. If you have difficulty, IBP can help you identify the number of habitat types that exist in your station and help you classify them according to NVCS codes (see front cover for contact information).

Step 5: Complete the MAPS Habitat description forms A single form is provided which you will need to photocopy (or download from our website) for each dominant, subdominant and minor habitat type that constitutes the station (Form H1: Habitat Assessment Form). The form allows you to indicate the dominance level of the habitat under consideration. For each habitat type, consider only the portion of that habitat that falls within the station boundaries. It is very important that you complete the habitat description every year, at the appropriate time, and without reference to previous descriptions. We feel strongly that two people should complete the assessment independently of one another, then compare results and reach a consensus opinion to minimize observer bias. ***We request that only the set of forms representing the consensus opinion be submitted to IBP: one HSA Form H1 for each habitat type present at the station and a completed station map (HSA Form H0).***

The following descriptions will help you understand how to fill in the various boxes on the Habitat Assessment Form. First we deal with the categories of cover and pattern which are used to describe the horizontal arrangement of different habitat types within your station. Similarly 'cover' and 'pattern' are also applied to the different vegetative layers within the habitat type. 'Cover' and 'pattern' are also used to describe the different elements of the ground cover layer (i.e. live vegetation, dead vegetation and non-vegetative features such as rock, sand or pavement). This provides us with a five tier hierarchical system; a station has habitat types, each of which has a number of vegetative layers. The ground cover layer itself has three components, of which the non-vegetative component can itself have four types of non-vegetative features.

Cover and Pattern

The two variables, **cover** classification and the **pattern** of that coverage, represent the most important information regarding the spatial characteristics of a habitat type, or of a vegetative layer (e.g., upperstory) or non-vegetative feature (e.g., standing water) within a single habitat type (e.g., forest). ***It is essential to understand these concepts as they are used consistently throughout this protocol!***

Cover: When describing habitat types, **cover** applies to the percentage of the station that is covered by that particular habitat type. When **cover** is used to describe upperstory, midstory, and understory vegetative layers, it is defined as the sum of the areas delimited by the vertical projections of plant perimeters onto the ground and not to light passing through the foliage of a single tree, shrub or fern. Consider any area inside the "drip-line" of the individual plant or tree as fully covered. Any overlap of cover between neighboring individual plants or trees is only considered once. ***In this case a***

completely closed canopy forest with overlapping crowns can only total 100% cover. In the case of ground cover, **cover** is defined as the percentage of the ground covered by live vegetation, dead vegetation or the various non-vegetative features. Note that the sum of these percentages must add up to 100% ground cover.

Coding of cover relies upon eleven categories representative of easily estimable ranges of percentage cover (Table 1). These categories represent the midpoints of the NVCS ranges of percentage cover. The eleven categories range from <5 to 10, 20, …, 90, >95, each representing the percentage midpoint of the percentage ranges indicated in Table 1. **Do not enter the raw percentages except when considering the total coverage of a habitat type or ground cover within a habitat type**.

Table 1**.** Cover categories based on the midpoints of the corresponding ranges of percent cover. These are also listed on the Habitat Assessment Form (Form H1) and in Figure 3.

Category	Range	Category	Range	Category	Range
<5	0-5%	40	35-45%	80	75-85%
10	5-15%	50	45-55%	90	85-95%
20	15-25%	60	55-65%	>95	>95%
30	25-35%	70	65-75%		

It is worth noting that when considering just two habitat types the cover category codes must be paired (<5 with >95; 10 with 90; 20 with 80; 30 with 70; 40 with 60; and 50 with 50).

Pattern: The variable **pattern** describes the overall horizontal spatial pattern of the target habitat type or vegetative layer. Basically, for a given percentage habitat cover, different spatial arrangements alter the perimeter:area ratio which reflects how 'simple', 'clumped' or 'dispersed' the pattern of a habitat or vegetative layer can be. For instance, nine cells arranged as a square patch of 3x3 cells represent maximum clumping and has a perimeter:area ratio of 12/9 = 1.33. Alternatively, nine cells arranged in 1x9 strip is less clumped with a ratio of 20/9=2.22, whereas nine isolated cells are maximally dispersed with a perimeter:area ratio of 36/9 = 4.

A high perimeter:area ratio with high cover defines a well connected landscape in which it is easy for an individual to move across the landscape through a single habitat type without crossing patches of other kinds of habitat – this is termed "connectivity". Conversely, the same percentage cover with a low perimeter:area ratio infers a clumped distribution that would provide a minimum patch size for a species to establish a territory or build a nest. Perimeter:area ratio is just one of a larger set of *landscape metrics* we can use to identify predictors of presence/absence of a species, species richness, or even species-specific productivity.

The spatial pattern of the main habitat types present at your station can be identified by matching the pattern you see in the field with one of twelve patterns illustrated in the Spatial Pattern Chart (Figure 2). These patterns are carefully chosen to represent commonly seen arrangements of natural and managed habitat patches with particular characteristics of "cover", "clumpiness" and "dispersion".

We have split these patterns into three main categories. Pattern codes 1-6 represent simple large patches with high clumping; codes 7-10 represent clumped distributions of smaller patches with increasing total coverage, and codes 11 and 12 represent highly dispersed habitat patches of

increasing total coverage. Pattern code 8 differs from pattern code 9 in that the clumps tend to be disconnected rather than connected; in fact, pattern code 8 is the inverse of pattern code 9. Compare these patterns with the descriptions and examples of each pattern code provided below in Table 2. Remember black cells represent the target habitat and white cells represent the non-target habitat. With only two habitat types present, pattern codes may also be paired (i.e. #2 with #3, #4 with itself, #5 with #6, #7 with #10, #8 with #9 and #11 with #12).

Table 2. Habitat Pattern categories with descriptions and examples which correspond to the graphical examples given in the Spatial Pattern Chart (Figure 2).

Code	Pattern	Description	Examples
1	SIMPLE - COMPLETE	Total cover of a single habitat type (or vegetative layer).	Prairie grassland, dense forest or any extensive habitat type.
2	SIMPLE SURROUNDED	A large patch of a single habitat type surrounded by another habitat type.	A meadow in a forest or a willow thicket within a meadow.
3	SIMPLE - SURROUNDING	A habitat type surrounding a patch of another type.	The forest around a meadow or the meadow around a thicket.
4	SIMPLE - EDGE	A habitat type with an edge that crosses the station.	The edge of a large forest where it meets grassland.
5	SIMPLE - DIVIDED	Large patch of habitat divided by another habitat type - extensive edge.	Woodland, forest or meadow either side of a riparian corridor.
6	SIMPLE - DIVIDING	Narrow habitat patch with extensive edge dividing another habitat type.	Riparian corridors, or bare ridgelines dividing forest habitat.
7	CLUMPED - LOW COVER	Varying sized habitat clumps spread through the landscape.	Clumps of shrubs invading a grassland prairie.
8	CLUMPED – MEDIUM COVER	A few large clumps of habitat type within the landscape.	Shrubby thickets in a divided watercourse.
9	CLUMPED – MEDIUM COVER	Narrow patches of intricately connected habitat with extensive edge.	Divided watercourse and associated wet meadows.
10	CLUMPED – HIGH COVER	Patches of non-habitat are spread throughout the landscape.	Nearly closed-canopy forest with clumped areas of selective logging.
11	DISPERSED – LOW COVER	Small isolated patches of habitat dotting the landscape.	Shrubs in a grassland or saplings in forest gaps caused by treefall.
12	DISPERSED – HIGH COVER	Almost homogenous patch but with well spaced small holes in it.	Mature forest with small clearings caused by treefall.

Cover and Pattern Exercise

The spatial pattern and coverage of a habitat type may preferentially attract certain species to breed there and also determines how individual organisms of many species move through the landscape. Some bird species that prefer to disperse through, or nest in, forest or woodland may avoid crossing large open spaces – they require their preferred habitat to be well connected. Some of these species may have a minimum forest patch size requirement and will not establish a breeding territory within a smaller sized patch. Other species may prefer the edge habitats provided by a more fragmented forest landscape (or grassland or shrub).

Consider Patterns #2, #7 and #11 in the context of a species that requires at least eight squares of contiguous habitat in order to establish a territory. All these patterns have 25% coverage of black squares but #2 is a single patch certainly big enough to hold three territories, and #7 is six variously sized patches – only one of which is big enough to hold a territory. On the other hand #11 consists of

many small highly dispersed patches, none of which could hold a territory for a species that requires eight contiguous squares of black habitat.

There is a clear shift in the level of connectivity between 40% and 60% coverage that depends upon how the clumped the patches are. For instance, pattern #8 is 50% covered with three discrete large patches of black habitat that are clearly not well connected. On the other hand Pattern #9 (the inverse of Pattern #8) also has 50% cover of black habitat through which an individual could move without crossing white habitat. The patterns presented in Figure 2 are typical of the kinds of pattern we see in nature. They are intended to be a guide to categorizing the spatial patterns of the main habitats within the boundaries of your station(s).

Consider Figure 3. This is an aerial photograph of part of the Fort Leonard Wood military installation in Missouri. The contrast has been adjusted to discriminate patches of forest and woodland (dark areas) from the shrub/grassland areas (light areas) and the roads and trails (white). If you have an aerial photograph (or GIS based habitat map) of your station(s) then it may help you determine the spatial pattern and coverage of habitat types and possibly the vegetative layers within them. Otherwise, try to picture the layout of your station from above – a bird's eye view if you like. Seven squares labeled A-G depict areas that represent boundaries of potential MAPS stations, each containing different patterns and cover categories of the two contrasting habitat types. The dark areas represent woodland and the light areas represent shrub/grassland habitat. We will refer to them as "tree habitat" and "scrub habitat." These patterns are intended to exemplify the stylized patterns shown in Figure 2. Test your perception in the following manner looking for the main features not the detail:

1. Consider first the tree portion (dark) within each of the squares A-G.
2. Assess the percentage cover and choose the nearest percentage cover midpoint. These are given on the bottom of the Figure 3 and in Table 1.
3. Enter the number in the space to the left of the slash character provided under the "TREE" column provided in Figure 3 (i.e. **10%** / | /).
4. Match the pattern of the tree portion with one of the patterns depicted in Figure 2.
5. Enter the number in the space to the right of the slash character provided under the "TREE" column. An example is provided for case A (i.e. 10% / **11** | /).
6. Repeat steps 1-5 this time considering only the scrub portion of the squares and enter the closest matching in the "SCRUB" column (i.e. 10% / 7 | **90% / 12**).

When you have finished compare your assessments with your partner (if you have one) and against the descriptions below. The first thing to realize is that everybody's perception is different – so expect there to be differences between your answers and those of your partner(s). This fact does not invalidate the approach for two reasons. First, hopefully you will have at least two individual opinions for each station from which to construct a consensus opinion. Second, we intend to apply "fuzzy logic" analyses to HSA categorical data to account for these differences. This kind of analysis is designed specifically to deal with the statistical issues surrounding human perception and categorical data such as that generated by this protocol.

Here are our reasoned interpretations of the "organic" example we provided in Figure 3:

A: [Tree 10% / 11, Scrub 90% / 12]. Lots of differently sized and shaped tree patches. Which is the dominant habitat type? Scrub has the higher cover category so scrub is dominant and tree is subdominant. To assess the percentage of tree cover imagine all the tree habitat dropped into a square shape in one corner. This would represent more than 5% of the total area, probably around 10%, so you enter that percentage in the cover column for tree habitat. Because there are only two habitat types, the scrub habitat must cover the remaining 90% (100% – 10%).

Although the tree coverage is high, is its spatial pattern clumped or dispersed? Obviously the choice is between the clumped Pattern #7 and the dispersed Pattern #11. We assigned Pattern #11 because we felt that Pattern #7 would be more appropriate for an area with fewer and larger patches. Consequently, habitat Pattern #12 was chosen to represent the pattern of the scrub habitat.

It is worth noting that when considering just two habitat types the cover category codes must be paired (<5% with >95%; 10% with 90%; 20% with 80%; 30% with 70%; 40% with 60%; and 50% with 50%;). Similarly, with only two habitat types, pattern codes may also be paired (#2 with #3, #4 with itself, #5 with #6, #7 with #10, #8 with #9 and #11 with #12).

B: [Tree 20% / 2, Scrub 80% / 3]. Scrunch your eyes together and what do you see? You should see that the main feature is a dark area (outlined in grey) in an otherwise white square? This represents a patch of open woodland and covers about the same area as the tree patches illustrated in (A) but arranged in a different pattern. Later we will look at the pattern *within* the patch labeled H.

C: [Tree 60% / 5, Scrub 40% / 6]. In this example the tree habitat covers close to 60% of the area, and therefore is the dominant habitat. The tree habitat is clearly divided by a wide strip of scrub habitat and is assigned Pattern #5. The complement to this for the subdominant scrub habitat would be 40% shrub cover and Pattern #6.

D: [Tree 70% / 4, Scrub 30% / 4]. This is a good example of the decisions you may have to make. The tree habitat cover is about 70% and some might choose *Dividing* (Pattern #6) for the tree habitat. Look again! The bottom left corner has many small tree patches so overall this is closer to Pattern #4 (*Edge*) than #6. Therefore, the scrub habitat is the tree habitat's cover and pattern complement of 40% cover and Pattern #4.

E: [Tree 30% / 6, Scrub 70% / 5]. The scrub habitat is obviously dominant but divided by a 30% cover of tree habitat (Pattern #5: *Dividing*). Again we entered the complementary codes for the percentage cover estimate (70%) and Pattern #6 of the scrub habitat.

F: [Tree 40% / 2, Scrub 60% / 3]. The tree habitat covers about 40% of the area arranged as a large patch (J) surrounded by scrub (Pattern #2: *Surrounded*). Scrub habitat is obviously dominant and encircles the patch (Pattern #3: *Surrounding*). Although there are other tree habitat patches present, they are minor with respect to the main features.

G: [Tree 80% / 10, Scrub 20% / 7]. Is the percentage cover of tree habitat 80% or 90%? We chose 80%. Is the pattern clumped or dispersed? For the scrub habitat we chose Pattern #7 (*Clumped – low*

cover) to describe the large patches of scrub present in the bottom corners; we then chose Pattern #10 (*Clumped -high cover*) to describe the tree habitat.

Now let us look at patterns and coverage within habitat types. Tree habitat patches H, I and J are dominant or subdominant tree habitat types that have their own internal structure. Up to now you have considered H, I, and J as patches of tree habitat in a larger scrubbier area, but what is it like inside those patches? Basically, choosing the cover and pattern codes within a habitat is what you do when filling in data for the vegetative layers on HSA Form H1. *At this stage it is important to realize that we now change scales - each of these patches is now considered as 100% and cover and pattern apply just to the patch itself.*

H: [Tree 50% / 8]. Surprisingly, within patch (H) only about 50% of the area is tree habitat arranged in fairly discrete smaller patches so its pattern is that of Pattern #8 (*Clumped – medium cover)*. In general, Pattern #8 may be typical of a tree plantation, golf course, or old orchard. Even some natural landscapes can resemble this pattern - think of riparian areas in which several channels converge (Pattern #9) leaving discrete patches of wooded bottomland (Pattern #8).

The following two examples may help you discriminate between a dispersed and a clumped pattern when percent cover of the target habitat type is high (>75%):

I: [Tree 90% / ??]. The trees are fairly continuous but with a few white patches, perhaps ~90% coverage (Cover category #10). Is this pattern closer to #10 than to #12 (discuss).

J: [Tree 90% / ??]. The trees are again fairly continuous (>90%) with a few white patches. Is the pattern closer to #10 than to #12 (discuss).

If H, I, or J were examples from your station you would be entering the cover and pattern you decided for the tree habitat in the spaces provided for "Upperstory" provided the average canopy height was greater than 15m. If average canopy height was >5m, but <15m, the cover and pattern codes would be entered for "Midstory".

Detailed directions for completing the Habitat Structure Assessment form

The Habitat Structure Assessment form (HSA Form H1) provides space in which to record the cover and pattern of the various habitats and their constituent layers. We provide below a guide to filling in each field of those forms. We also provide, based on the example station map (Figure 1), a completed form H1 for the dominant forest habitat (Figure 4).

LOCATION CODE: Enter the four-letter code of the MAPS location to which your station belongs.

STATION CODE: Enter the four-letter code of your MAPS station.

DATE: Indicate the month, day and year on which the habitat assessment is undertaken. We recommend you do this during the fourth visit to your station (not necessarily Period 4).

SURVEYED BY: Enter your name in this space.

SURVEY: Circle the appropriate survey type. We prefer that each of at least two surveyors conduct the assessment without consulting each other. When these are complete, the discrepancies between the two forms should be discussed and a consensus opinion formulated. Fill in another set of forms to reflect this consensus opinion and circle "consensus" – remember the consensus set of forms is the only set IBP requires. *If only a single surveyor conducts the assessment, her/his forms should be submitted to IBP with "single" circled on each form.*

HABITAT DOMINANCE CODE: Circle the appropriate dominance code to reflect the area you are describing. The letter (A, B, C, D or E) should correspond to the labeling of the habitat types marked on your station map (see page 4: Step 4).

DESCRIBE HABITAT TYPE: As most of you are familiar with the plant alliances within your station please provide a succinct description of the habitat type in your own words. The NVCS alliance codes are still being developed and the habitat description (along with the "General Description" and "Species Names"; see below) will provide ranges of data associated with alliance codes. Examples might include a forest association: "Red oak, white oak and hickory woodland with dogwood, poison ivy and muscadine vine understory." Alternatively the habitat might be non-forested: "Californian coastal sage scrub", "Old field", "Lowland wet meadow" or "Montane meadow".

SUCCESSIONAL STAGE OF HABITAT TYPE: Circle the appropriate successional stage code (late, mid or early) by which the habitat can be described. This is relative to the habitat type so that, for example, a 40-year-old mixed oak/hickory deciduous forest could be described as mid-successional but after 60-70 years the canopy might be closed and it would be described as late-successional. On the other hand, a 60-year-old redwood forest would be described as early-successional.

NATIONAL VEGETATION CLASSIFICATION STANDARD FORMATION: This is obtained from the National Vegetation Classification Standard (1997) which we have summarized in Appendices 1- 6. Appendix 1 provides the background and instructions on how to use the hierarchical classification system. Appendix 2 provides a key to the NVCS codes at the "Formation" level of the hierarchy (e.g., IA8Ng: Saturated temperate or subpolar needle-leaved evergreen forest). Appendix 3 provides a glossary of the terms used in the classification system.

Please note that "cover" in the NVCS system is defined as the sum of the areas delimited by the vertical projections of plant perimeters. There is an important distinction to be made between forest and woodland with regard to cover: generally, in a forest the crowns overlap and total cover is between 60 and 100% but in woodlands the crowns do not overlap and cover is less than 60%.

NATIONAL VEGETATION CLASSIFICATION STANDARD ALLIANCE: Appendices 4-6 provide regional lists of NVCS alliance level codes and one-line descriptions of the dominant species in those alliances (see Appendix 1 for details). Use the NVCS Formation Code to limit the options, then choose the Alliance code that best describes the habitat being assessed. If a habitat type within

your station is atypical for the region and is not represented by a NVCS alliance code in your regional list, you can obtain help from IBP or choose from the regional lists provided on our website. Be sure to enter only the Alliance number in the second column of Appendices 4-6 (e.g., 16 or 100).

PERCENTAGE OF STATION COMPRISED OF THIS HABITAT TYPE: What percentage of the area of the station (within the boundaries defined in Step 2 of the step-by-step instructions) is occupied by the habitat in question? The sum of the percentages for each of the habitat types defined at the station (up to five) should generally be 100%. Small patches (<1 hectare, or <5% of the total area) of distinct habitat types must be lumped into the habitat type they appear to be associated with and described in the vegetative (or non-vegetative) layers. For instance, the presence of a few bushes around the edges of a meadow can be described in the shrub layer of the meadow habitat description and not treated as a separate habitat.

PATTERN CODE OF THIS HABITAT TYPE: Enter the spatial pattern category (from Figure 2, also see Table 2) that best matches the pattern of the habitat type under consideration. Remember that the black cells represent the habitat type of interest and the white cells represent all other habitat types (pooled) that are present at your station.

AVERAGE HEIGHT OF TREE CANOPY: Enter the average height to the nearest 5m (or nearest 2m if the average height is less than 15m) of the tree canopy in the habitat type under consideration. Remember, trees are defined as woody, generally single-stemmed plants that are at least 5m tall at maturity. Do this regardless of whether the tree canopy extends into the upperstory, midstory, or only into the understory (see below). This can be achieved by drawing an imaginary line running through the tops the canopy whereby the area of the outlines of trees above the line equals the area of the gaps below it (*ignore gaps that reach the ground*). Estimates obtained using a clinometer are preferred but we understand that few stations have one. If you are working in a managed forest or woodland it is likely that the responsible land manager(s) can provide this information.

AVERAGE HEIGHT OF SHRUBS: Enter the average height to the nearest 0.5m of the shrubs (woody, generally multi-stemmed plants with a bushy appearance) in the habitat type under consideration. Note that when considering the understory vegetative layer (below), you will estimate the cover and pattern of all vegetation between 0.5 and 5m, regardless of whether it is comprised of trees (except trunks), shrubs, or herbaceous vegetation. Here, we are asking only for the average height of the shrubs.

AVERAGE HEIGHT OF HERBACEOUS VEGETATION: Enter the average height to the nearest 0.1m of the herbaceous (non-woody, vascular) vegetation, which includes graminoids (grass-like vegetation including grasses, sedges, rushes, etc.), forbs (broad-leaved herbaceous vegetation), and ferns. Again, note that when considering the live vegetation of the ground cover vegetative layer (below), you will estimate the cover and pattern of all vegetation below 0.5m, regardless of whether it is comprised of the seedlings of woody vegetation, herbaceous vegetation, or non-vascular vegetation (mosses and lichens). Here, we are asking only for the average height of the herbaceous (graminoids, forbs, and ferns) vegetation.

VEGETATIVE LAYERS: Divide the vegetation within each habitat into four main layers; upperstory, midstory, understory, and ground cover, based solely on their height as described below.

As a general rule, the trunks of standing live or dead trees count for cover only in the highest layer that the trees reach.

Upperstory: This vertical layer encompasses all vegetation above 15m from the ground, including coniferous or broad-leaved trees, vines, and epiphytic plants and lichens.

Midstory: This vertical layer encompasses all the vegetation between 5 and 15m above the ground, including saplings and tall shrubs as well as vines, epiphytic plants and lichens, and vegetation hanging down from the upperstory level. Do not include the trunks of trees that reach into the upperstory in the cover of this layer.

Understory: This vertical layer includes vegetation found between 0.5 and 5m above the ground and includes mainly shrubs and small saplings. In addition, this layer may also contain herbaceous vegetation extending up from the ground cover layer. Do not include the trunks of any trees that extend into the upperstory or midstory in the cover of this layer. Also, do not include the trunks of fallen trees, regardless of their size, in the cover of this layer.

Ground cover: This layer includes all the vegetation below 0.5m as well as everything on the ground. Do not include in the cover of this layer the trunks of any trees that extend above this layer or the woody stems of shrubs that extend into the understory. Do include the trunks of fallen trees. This layer is itself split into three components described below:

> **Live vegetation:** Includes seedlings of woody vegetation, grass-like vegetation (graminoids within which we include grasses, sedges, and rushes), forbs and ferns, and nonvascular vegetative ground cover (including mosses and lichens).
>
> **Dead vegetation:** Includes all the dead leaves, empty seed cases, twigs, branches and logs that lie on the ground in the habitat in question.
>
> **Total non-vegetative:** Includes bare ground covered by rock, stones or gravel, sand or dirt, water or human-made cover such as roads, parking lots and other development. ***If this sub-layer has any percentage associated with water or human-made features then the next section of the form (*****Non-vegetative layers*****) must be filled in to describe those features in detail.***

COVER: Enter the cover category (<5, 10, … 90, >95) of each of three layers (upperstory, midstory, understory) from Table 1. The cover category should represent the percentage cover of the layer **within** the habitat type and **not** the percentage cover of the area of the entire station. Imagine a meadow that has shrubs dotted over it and reshape the area into a square, pushing the shrubs into one corner. Let us say, for instance, they cover somewhere between 5% and 10% of the entire area, then you would enter 10 (to reflect the range 5-15%) into the data sheet for the understory. In the case of the ground cover layer, provide an estimate of the ***absolute percentage*** of the habitat type covered by each of the three components of the ground cover as described above: live vegetation, dead vegetation, and non-vegetative ground cover. Note that these three percentages must add up to 100%. ***It is essential to enter the cover category for at least one of these three components (there must be something on the ground!).***

PATTERN: Enter the number of the spatial pattern that the vegetative layer (or non-vegetative feature) most closely resembles (refer to Table 2 and Figure 2). Remember that black cells represent the target layer and the white cells represent all other layers (or features). Pattern code #1 might be used to describe the ground cover live vegetation of a mown, or grazed grassland habitat type. In general, pattern codes between #2 and #6 are rarely chosen for vegetative layers. Exceptions include a closed upperstory forested habitat area: a) surrounding a clearing insufficiently large enough to be considered a separate habitat type (#3: *Surrounding*), or b) with a fire road dividing it (#5: *Divided*). ***It is essential to enter a spatial pattern wherever a cover category has been supplied (except for total non-vegetative cover).***

NUMBER OF SPECIES: For each vegetative layer, we wish to assess how diverse it is in terms of number of species. Enter the number of species present. Obviously for vegetative layers that are especially botanically diverse you need only enter the approximate number of species (e.g,"~50").

VEGETATION TYPES WITHIN EACH LAYER: Within each vegetative layer, record the approximate percentage cover of woody coniferous, woody broad-leaved, (total woody for the ground cover layer), forbs and ferns, graminoids (grass-like), and non-vascular vegetation types in that layer alone. The sum of the percentages of the various vegetation types in the layer must equal 100%. For example, even though a woodland upperstory layer may only have a cover class of 30 (25-35% cover), coniferous trees may comprise 60% of the upperstory and broad-leaved trees 40% of the upperstory. In this case you should enter 60% for "Conifer" and 40% for "Broad" in the appropriate columns.

Vegetation in the middle layers may contain vegetative material originating from lower or higher layers. For instance, the understory may contain branches hanging from the upperstory or midstory, and may contain forbs, ferns, and grasses emerging from the ground cover layer. Trunk coverage in all but the highest layer the trees reach can be ignored. Each of the four layers contains differing numbers of component vegetation types – in each layer, the sum of the vegetation types must total 100%. For the upperstory and midstory layers, only three vegetation types (woody coniferous, woody broad-leaved, and forbs and ferns (which encompasses vines, epiphytic plants, and lichens)) must total to this 100%. For the understory, up to four vegetation types (woody coniferous, woody broad-leaved, forbs and ferns, and grass-like) may be present, the percentages of which still must total 100%. For the ground cover layer, up to four vegetation types may also be present, which again must total 100%. In this case, they are total woody, non-vascular (includes mosses and lichens), forbs and herbs, and graminoids (grass-like).

Circle the types of dead vegetation (leaves, twigs, branches, old logs or recent treefalls) that individually comprise 10% or more of the dead vegetation present. Also, please circle the types of non-vegetative cover (rock, stones or gravel, dirt or sand, water, or human-made) that individually comprise at least 10% of the non-vegetative cover.

MAIN SPECIES: This space allows you to list the dominant and more common species in each vegetative layer (***preferably scientific names***) or comment on the dead vegetation or non-vegetative layers. ***N.B. This information must be completed for all layers in which some cover is reported – if common names are used they must be specific (e.g., "Northern Red Oak" not just "Oak").***

NON-VEGETATIVE FEATURES: There are four kinds of non-vegetative features, that are of particular interest, which may occur within your station: running water, standing water, human-made corridors, and human-made structures. Determine the **cover and pattern** of these layers within each habitat type and enter the appropriate codes. Please note that all these features should be indicated clearly on your station map. Let us consider the types of features individually:

Running water: Running water courses range in width from a seep/trickle, to a very small brook (<0.5m), a small stream (0.5-2.0m), a large stream (2.0-5.0m), a river (>5.0m) or canal. Circle the main features you see within the station but restrict the pattern of coverage to Spatial Pattern categories 4, 6 or 9 (Figure 2).

Standing water: Standing water includes ponds and lakes (<50m^2 or >50m^2), water catchment for livestock (<50m^2 or >50m^2), or marsh/bog areas (<50m^2 or >50m^2). Such water bodies may be permanent, seasonal (vernal pools) or occasional (flooded field). For example, if ponds occur within a meadow and normally have water in them year-round, then you would circle natural pond, permanent and the size category <50m^2 or >50m^2 (if both size classes occur circle both). If there is standing water at your station that does not fit any of these categories, circle other and write a brief description in the comment section.

Human-made Corridors: This category includes all linear or curvi-linear features on which vehicles, people, pack animals, and livestock travel and include roads, tracks, breaks or paths longer than 30m. Do not include net paths this category. These features may be constructed of varying types of substrate, paved, gravel, dirt, or mown. If a gravel road occurs within the station then you would circle gravel and road. If there is a human-made corridor at your station that does not fit any of these categories, circle other and write a brief description in the comment section. ***DO NOT include net paths in your consideration because all stations have net paths.***

Human-made Structures: This category includes all man-made structures such as buildings, bridges, power poles, observation towers, dams etc. Such structures are often utilized by some avian species such as nesting swallows, or perching hawks and owls. Circle those types present and indicate their positions on the station map. If there is a human-made structure at your station that does not fit any of these categories, circle other and write a brief description in the comment section

COMMENT: Provide comments, as appropriate, for each non-vegetative feature (e.g., spring fed stream, vernal pools, or 10m powerline poles).

GENERAL DESCRIPTION OF HABITAT TYPE INCLUDING HABITAT AGE: It is essential that you give a general description of the habitat type in the space provided (you may provide us with a separate sheet if necessary). This allows you to provide more detailed information than the shorter "Describe habitat type:" at the top of the form. The following example was adapted from a station description provided by a MAPS station operator:

"Located along a small ridge between two valleys (approx. altitude in valleys is 150 m). This wooded area consists of oak (southern red predominates with some black and white), hickory, and

poplar. Other species are Carolina buckthorn, ash, cherry, sweet gum, black gum, dogwood, etc. Vines are muscadine, poison ivy and rattan vine along with Japanese honeysuckle. Very little shrub undergrowth, mostly huckleberry/blueberry types."

All this information **must** be indicated on the HSA Form H1. In this case the plant species mentioned must be provided in the "Main Species" column of the upperstory, midstory, and understory layers. Also, some clearly defined options can be selected to summarize the drainage, slope, geography, ridge and aspect features of the description (see Figure 4 for a completed example based on Figure 1).

Drainage – circle one option (well-drained or poorly-drained) that best represents the drainage characteristics of the habitat. Remember that this is relative to the normal range you would expect for that habitat type.
Slope – circle one option that best represents the topography of the habitat: flat, gently sloping, undulating or steep. This is a judgment call but not a difficult one.
Geography – indicate if the habitat is associated with a bottomland, hillside, ridgetop or plain.
Ridges - if ridges are present, circle whether there is a single dominant ridge, two, or more than two equally dominant ridges that occur within the boundaries of the station.
Aspect – this represents the orientation of the main feature to the compass points. If for instance, the station lies on a southwest-facing slope you would circle 'S' and 'W'. Circle 'none' if the terrain is flat and 'all' if the habitat type extends all the way around a hill. If you have circled "hillside" for geography, and 'S' and 'W' for aspect then we assume more than 50% of the area of the station is located on the SW facing slope of the hillside.

NUMBER OF SNAGS: Circle the number (0, <5, 5-15, >15) that best represents the number of snags present in the habitat type under consideration. ***Snags are defined as dead woody stems greater than 1m in height and greater than 10cm in diameter.***

MANAGEMENT/DISTURBANCE HISTORY: Enter a brief description of the management history (e.g., I estimate that the area was probably logged in the late 1940's/early 1950's". Then circle the appropriate option(s) describing the type of management practice or disturbance, if any apply (e.g., Year(s) occurred:1945-55 Logging:clear-cut)). The logging patterns may be indicated by circling clear cut (of at least 1 hectare), selective (small patches <1 hectare in extent, or individual trees), or a strip of trees (removed for a powerline, for example).

Briefly describe disturbances and associate them with a year or range of years, then circle the cause: fire, wind (vegetation flattened, felled or broken by storm action), scoured by flood, altered by being drained, or affected by icestorm. Other disturbances are too numerous to specify so please write them in the space provided. They might include grazing, mining, pest infestation (and subsequent application of herbicides/pesticides), glacial retreat, mowing and clearing of ground cover. In eastern and boreal areas pest outbreak may be severe in some years and this should be recorded in the notes.

A space is provided for a general description of management practices or disturbance regime. This is especially important if the practices or regime is not listed, examples might include '***Forest understory underwent prescribed burn in 1994'*** or ***'avalanche scoured most of the west-facing slope'***. Space is available for entering the years in which disturbances occurred. Study Figures 1 and 4

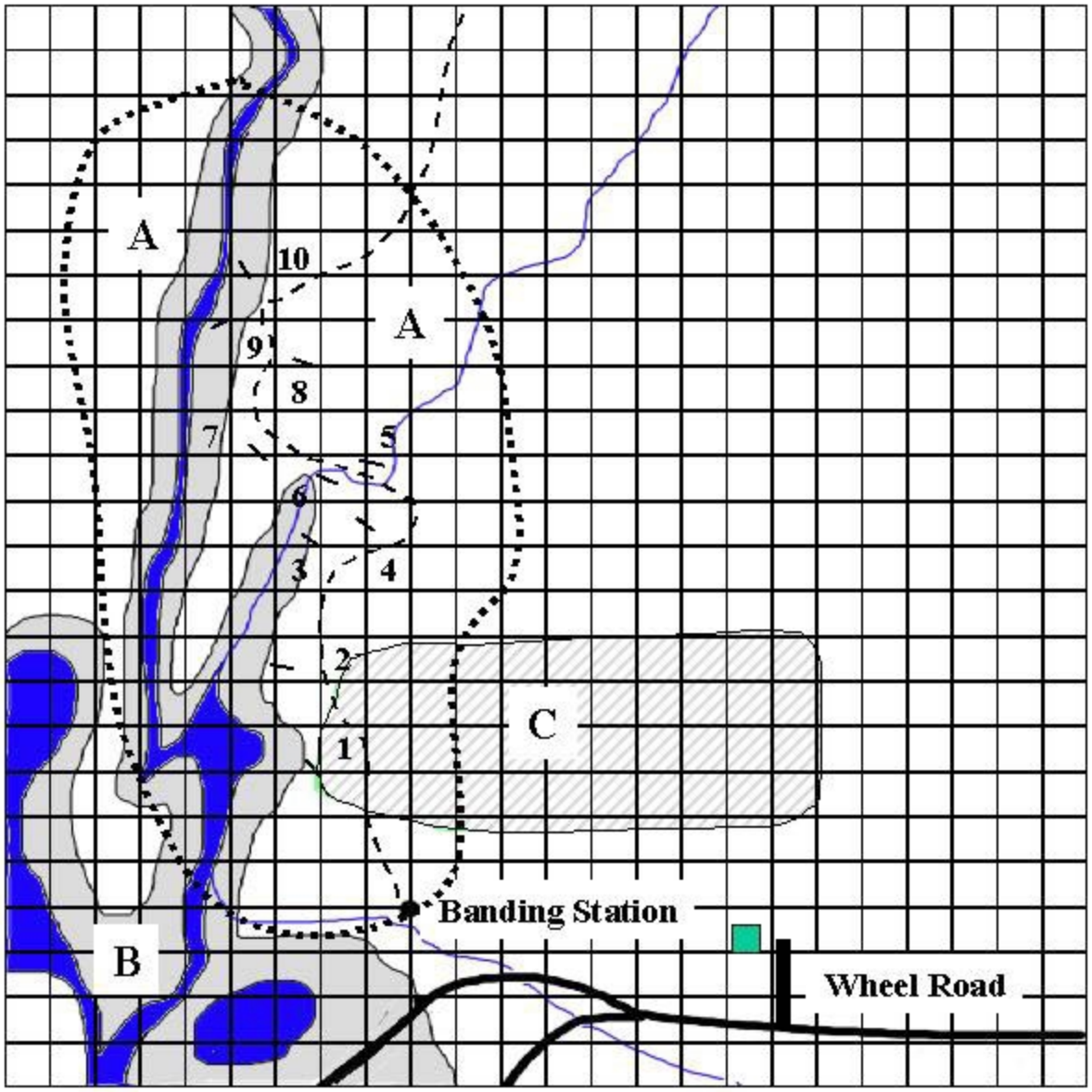
to see how some of the information given on the station map translates to HSA Form H1.

In previous years our biggest problem was that some fields were not filled in for one or another reason. This is always a problem with form filling – Does a blank indicate a zero or a missed field? The most common omissions were percentages for "Vegetation types within each layer" (Conifer, Broad, Forbs and Grass-like fields), and no "Pattern" code where a "Cover" code existed. Please put a dash (-) in fields that are not applicable to indicate that you have considered them.

If you have any questions contact Dr. Philip Nott at (415) 663-2050 (pnott@birdpop.org).

Figure 1: Example of completed MAPS station map

Form H0: MAPS Station Map Location: H A L F Station: H A F R Date: (m/d/y) 07 / 23 / 2003



Habitat types (>=5% cover of station)

A Sycamore/Tulip Poplar/Sweetgum forest

B Black Willow/Ash riparian woodland

C Norway Spruce/White Pine woodland

D

E

Indicate North with arrow

N

Indicate scale in meters (normally 30m per block)

150m

Figure 2: Spatial Pattern Chart for Habitat Structure Assessment Protocol

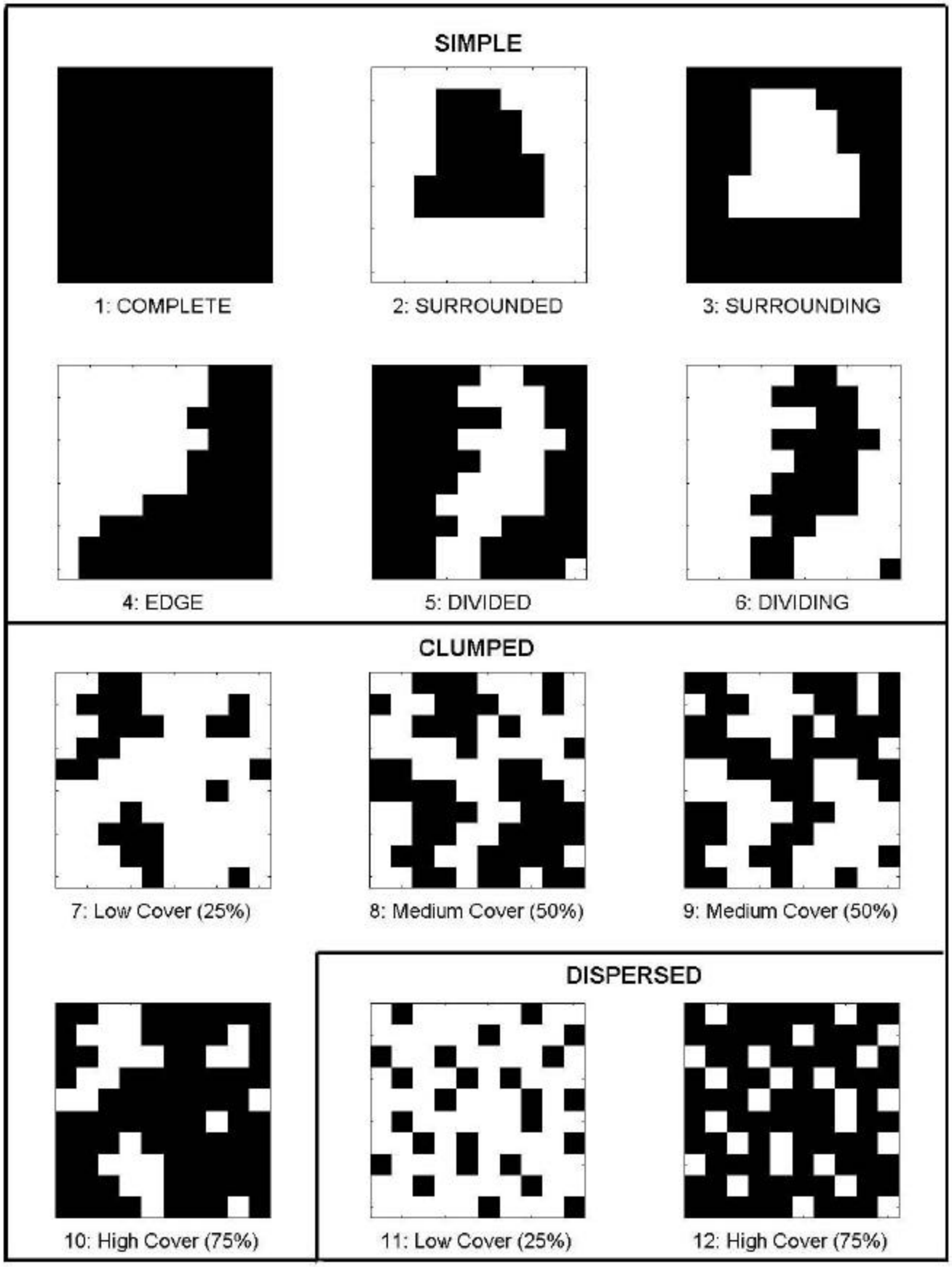
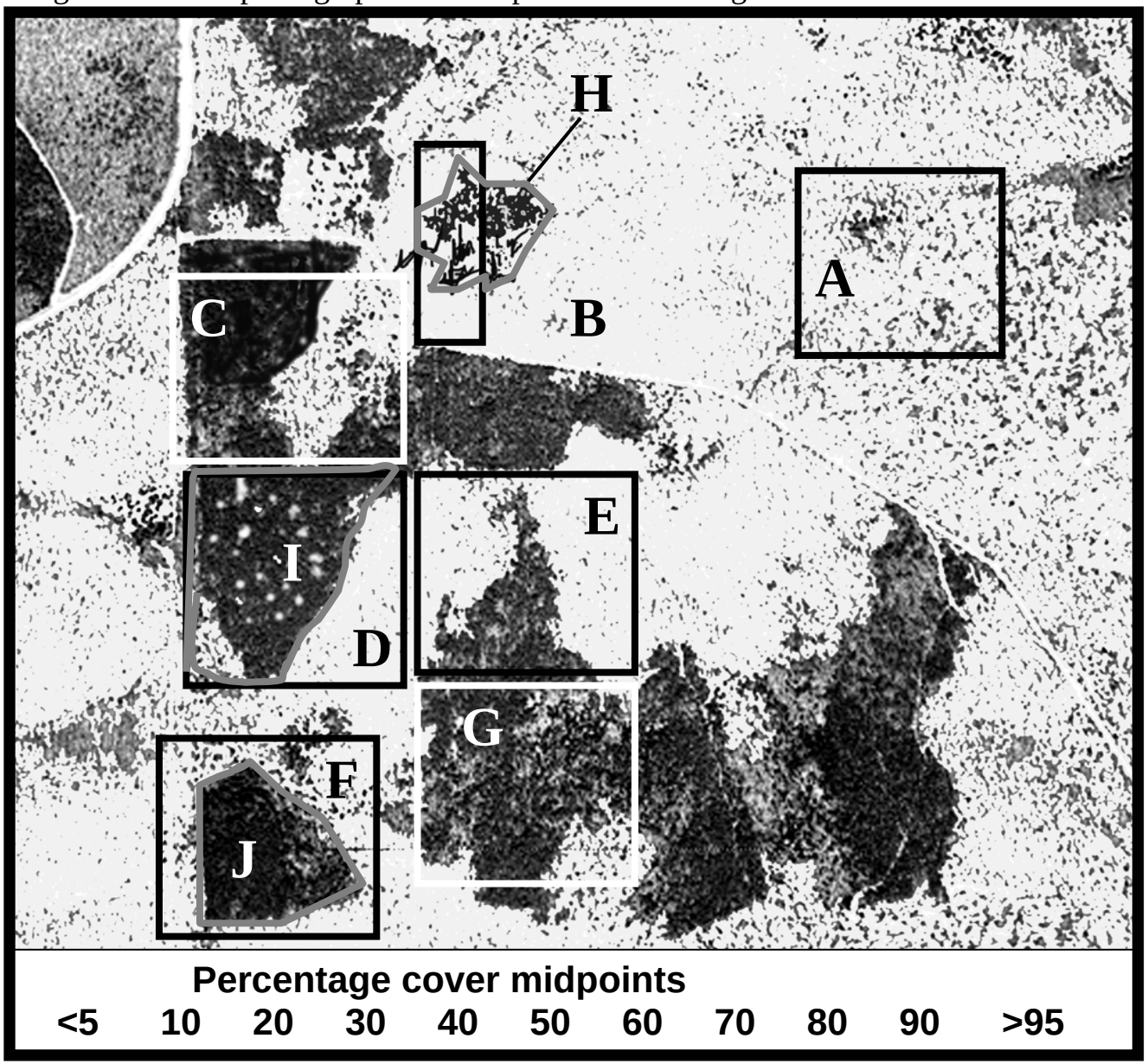


Figure 3: Aerial photograph of forest patches in shrub/grassland matrix in Missouri



Cover and Pattern Exercise

Enter ***cover% / pattern code*** for each habitat type within each square labeled B-G. (see text pages 7-10):

	TREE	SCRUB
A	10/11	90/12
B	___/_	___/_
C	___/_	___/_
D	___/_	___/_
E	___/_	___/_
F	___/_	___/_
G	___/_	___/_

Enter ***cover% / pattern code*** for the coverage of tree habitat within the delineated areas labeled H-J:

Tree patches

H	___/_
I	___/_
J	___/_

Figure 4: MAPS Habitat Structure Assessment (HSA) form H1 – Example of completed form for dominant habitat type

Location code: H A L F Station code: H A F R Date: (m/d/y) 07/23/ **2003** Surveyed by: Jane Intern, John Helper Survey (circle one): single | consensus

Habitat dominance code (as shown on station map; circle one): A – dominant | B – sub-dominant | C – minor 1 | D – minor 2 | E – minor 3

Describe habitat type: Sycamore, Tulip Poplar, Sweetgum Forest

Successional stage of habitat type (circle one): L – late | M – mid | E – early National Vegetation Classification Standard Formation: IB2Nd

Percentage of station comprised of this habitat type (from station map): 62 % National Vegetation Classification Standard Alliance : 14

Pattern code of this habitat type (1-12): 5 Average height of: Tree canopy 20 m, Shrubs 2.0 m, Herbaceous vegetation 1.2 m

Vegetative Layers	Cover[1] <5, 10, 20,... see below...90, >95	Pattern 1-12	Number of Species	Vegetation types within each layer *Estimated percentages must add up to 100%* Conifer	Broad	Forbs & ferns	Grass-like	Main species *e.g. Vaccinium ovatum, Poa pretensis Quercus rubra, Q. alba, Pinus contorta*
Upperstory: >15m	80	12	5	1 %	99 %	0 %		Platanus occidentalis, Liriodendron tulipifera, Liquidambar sp.
Midstory: 5 -15m	40	11	8	5 %	95 %	0 %		P. occidentalis, L. tulipifera, Ostrya virginica, Acer rubrum
Understory: 0.5 - 5m	40	8	14	2 %	85 %	12 %	1 %	Rosa floribunda, Spice bush
Ground cover*: <0.5m Live vegetation	15 %	7	15	**Woody** 5 %	**Nonvascular** 2 %	**Forbs & ferns** 70 %	**Grass-like** 23 %	Nettle, grass, R. floribunda
Dead vegetation	72 %	10	leaves	twigs	branches	old logs	recent treefall	Mostly dead leaves
Total non-vegetative	13 %	**NA see text p.13**	rock	stones or gravel	dirt or sand	water	human-made	Mostly water & duff

Non-vegetative Features	Estimate %	Pattern 1-12	Circle one or more features of cover type					Comment
Running water	1 %	6	seep/trickle	very small brook	small stream	large stream	river	Permanently flowing
			canal	(<0.5m)	(0.5-2.0m)	(2.0-5.0m)	(>5m)	Small stream, spring-fed
Standing water	2 %	2	pond/lake $<50m^2$ | $>50m^2$	for livestock $<50m^2$ | $>50m^2$	marsh/bog $<50m^2$ | $>50m^2$	seasonal occasional	permanent other	Shallow marshy area, After spring runoff
Human-made Corridors	___ %	___	paved	gravel	dirt	mown	boardwalk	
			road	track	break	path	other	
Human-made Structure	___ %	___	building	fence	bridge	powerline	tower	
			culvert	dam	channel	wall	other	

General description of habitat type including habitat age: Second-growth woods on gently sloping hillside, on either Side of a riparian corridor containing a few > 100 year-old Sycamore trees. Lies on well-drained (mostly) Calcareous substrate.

Number of snags(>1m tall, >10cm diam.): 0 | <5 | 5-15 | >15

Management / Disturbance history: None since clearcut in 1945. Lower portions Heavily flooded by '83 hurricane.

Year(s) occurred:	1945	
Year(s) occurred:	1983	
Year(s) occurred:		

Feature	Options
Drainage:	well-drained | poorly-drained
Slope:	flat | gentle | undulating | steep
Geography:	bottomland | hillside | ridgetop | plain
Ridges:	none | single | two | >2
Aspect:	none | N | E | S | W | All
Logging:	clear-cut | selective | strip
Disturbance:	fire | wind | flood | drained | icestorm
Other:	write here

Percentage cover midpoints	**<5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**>95**
Percentage cover range	**0----5%**	**--------15%**	**--------25%**	**--------35%**	**--------45%**	**--------55%**	**--------65%**	**--------75%**	**--------85%**	**--------95%**	**----100%**

** Ground Cover (Live vegetation, Dead vegetation, and Total non-vegetative) must total 100%*

Background

The National Vegetation Classification Standard (NVCS) was drafted in 1997. This standard will be adhered to by the HSA protocol in order to maintain consistency with the eventual publication of the NVCS spatial database. The HSA protocol is similar to the field data forms used by NVCS contributors but is more detailed. Below are two excerpts from published literature dealing with the objectives of creating this standard.

Vegetation Classification and Information Standards **http://www.fgdc.gov/standards/status/sub2_1.html**

The overall objective of the Vegetation and Information Standards is to support the use of a consistent national vegetation classification system (NVCS) to produce uniform statistics in vegetation resources from vegetation cover data at the national level. It is important that, as agencies map or inventory vegetated Earth cover, they collect enough data accurately and precisely to translate it for national reporting, aggregation, and comparisons. Adoption of the Vegetation Classification and Information Standards in subsequent development and application of vegetation mapping schemes will facilitate the compilation of regional and national summaries. In turn, the consistent collection of such information will eventually support the detailed, quantitative, geo-referenced basis for vegetation cover modeling, mapping, and analysis at the field level.

Excerpt from the Executive Summary of the NBS/NPS Vegetation Mapping Program (Final Draft) Regarding the use of the Standardized National Vegetation Classification System.

The objective of the National Biological Survey/National Park Service (NBS/NPS) Vegetation Mapping Program is to develop a uniform hierarchical vegetation classification standard and methodology on a Service-wide basis and, using that classification standard and methodology, to generate vegetation maps for most of the park units under NPS management. This Program is in response to the National Park Service's Natural Resources Inventory and Monitoring Guideline (NPS-75) issued in 1992. The vegetation data are to be automated, in a GIS-compatible format, which will provide great flexibility in map design and production, data analysis, data management, and maintenance activities. Deliverable products will include a digital file of vegetation maps, digital metadata files, textual descriptions and keys to the vegetation classes, hard-copy maps, and map accuracy verification reports.

The use of a standard national vegetation classification scheme and mapping protocols will facilitate effective resource stewardship by ensuring compatibility and widespread use of the information throughout the NPS as well as by other federal and state agencies. These vegetation maps and associated information will support a wide variety of resource assessment, park management, and planning concerns. They will provide a structure for framing and answering critical scientific questions about vegetation types and their relationship to environmental processes across the landscape. They will provide a consistent means for the inventory and monitoring of plant communities and, they will support "ecosystem management" by providing a consistent basis for the characterization of the biological components of different ecosystem units.

Choosing the appropriate alliance to describe HSA habitat types

We have provided Appendices 2-6 to help you determine the NVCS Alliance level corresponding to any habitat type associated with your MAPS station. Depending upon your location only the appropriate one or two Appendices 4, 5 or 6 is (are) included in your HSA packet.

Appendix 2: LEVELS OF THE CLASSIFICATION HIERARCHY: Description to Formation Level This document outlines the upper levels of the NVCS hierarchical classification system and will help you narrow down your search for the appropriate alliance to describe a habitat type.

Appendix 3: Provides a glossary of terms used in the NVCS descriptions.

Appendix 4: Provides a hierarchical list of NVCS alliance names and codes for the Eastern North American region covering: AL, AR, CT, DE, FL, GA, IA, IL, IN, KY, LA, MA, MD, ME, MI, MN, MS, MO, NC, NH, NJ, NY, OH, PA, RI, SC, TN, VA, VT, WI, and WV.

Appendix 5: Provides a hierarchical list of NVCS alliance names and codes for the Central North American region covering: AR, CO, IA, KS, LA, MN, MO, MT, ND, NE, NM, OK, SD, TX, and WY.

Appendix 6: Provides a hierarchical list of NVCS alliance names and codes for the Western North American region covering: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, and WY.

Step 1. Study the first page of HSA Appendix 2 and make sure you understand the NVCS hierarchy and how codes are constructed.

Step 2. Use Appendix 2 to first narrow the search down to the FORMATION level code (e.g. IA8Nc - Giant temperate or subpolar needle-leaved evergreen forest). In Appendix 2 we provide a list of CLASS (e.g. I – Forest) level codes and their definitions. Under this there is a list of SUBCLASS level (e.g. IVA – Dwarf-shrubland) codes and the page numbers corresponding to the starts of the lists of GROUP/Subgroup and FORMATION level codes under that SUBCLASS. Choose the appropriate FORMATION code that describes the habitat type you are interested in.

Step 3. Once you have selected the FORMATION level code that corresponds to the general type of habitat you are trying to define move to Appendix 4, 5 or 6 (depending which region you are in – see above).To help you search the regional ALLIANCE lists for the alliance that describes your habitat type we have provided the page numbers upon which each CLASS (I-VII) level starts. Scan the list until you find the FORMATION code you selected from Appendix 2, under which is a list of the component ALLIANCES for that FORMATION (e.g. IIBNa1 - *Sequoiadendron giganteum* forest). **Enter the chosen NVCS Alliance code in the space provided at the top of HSA Form H1.**

If, however, the habitat type you are considering is not described by any of the NVCS Alliances it is either not yet defined by NVCS, or is atypical for your region but may exist in a neighboring region. Firstly ensure that you record at least the FORMATION code, species names (please provide scientific names if possible), and an appropriate description of the habitat on HSA Form H1. You may also contact Phil Nott in case the alliance is atypical of your region but appears in a neighboring region – obviously it is cost limiting to send all persons the entire North American list of alliances.

UPPER LEVELS OF THE CLASSIFICATION HIERARCHY: Description to Formation Level

The upper levels of the NVCS hierarchical classification system are organized as follows:

CLASS - Study these definitions and choose the appropriate class of your habitat type:

I. **FOREST**: Trees with their crowns overlapping (generally forming 60 - 100% cover)

II **WOODLAND**: Open stands of trees with crowns not usually touching (generally forming 25 - 60% cover). Canopy tree cover may be less than 25% in cases where it exceeds each of shrub, dwarf-shrub, herb, and nonvascular cover, respectively

III. **SHRUBLAND**: Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching (generally forming >25% cover, trees generally <25% cover). Shrub cover may be <25% where it exceeds each of tree, dwarf-shrub, herb, and nonvascular cover, respectively. Vegetation dominated by woody vines is generally treated in this class

IV. **DWARF-SHRUBLAND**: Low-growing shrubs usually under 0.5 m tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs generally less than 25% cover). Dwarf-shrub cover may be less than 25% where it exceeds each of tree, shrub, herb, and nonvascular cover, respectively

V. **HERBACEOUS**: Herbs (graminoids, forbs, and ferns) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with <25% cover). Herb cover may be <25% where it exceeds each of tree, shrub, dwarf-shrub, and nonvascular cover, respectively

VI **NONVASCULAR**: Nonvascular cover (bryophytes, non-crustose lichens, and algae) dominant (generally forming >= 25% cover). Nonvascular cover may be <25% where it exceeds each of tree, shrub, dwarf-shrub, and herb cover, respectively

VII.**SPARSE VEGETATION**: Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 25% and greater than 0%)

SUBCLASS[1] – Choose a subclass from one of these descriptions then go to that page number to choose the correct alliance:

GROUP and **Subgroup** (e.g., in "IA4N," Group is indicated by the arabic numeral '4' and, for Subgroup, "N" signifies natural/semi-natural while a "C" would mean planted/cultivated

FORMATION – each formation is indicated by a lower-case letter and is made up of a variety of plant alliances

***ALLIANCE* - these are listed in Appendices 4-6 depending upon your region**

If the habitat type you are considering is not described by any of the NVCS Alliances given in Appendices 4, 5, or 6 YOU MUST make sure that on Form H-1 you have:

a) provided an appropriate habitat description,
b) provided a list of dominant species (preferably latin names) in the MAIN SPECIES column, and
c) filled in the National Vegetation Classification Standard alliance code as far as the level of FORMATION.

You may also contact Phil Nott in case the alliance is atypical of your region but appears in a neighboring region.

[1] The terms used in this key are defined in the NVCS glossary (Appendix 3)

I. FOREST. Trees with their crowns overlapping (generally forming 60 - 100% cover)

I.A. Evergreen forest - evergreen species generally contribute >75% of the total tree cover

I.A.1. Tropical or subtropical broad-leaved evergreen rainforest (broad-leaved evergreen trees, neither cold- nor drought-resistant)
- I.A.1.N.a. Lowland tropical or subtropical rainforest
- I.A.1.N.b. Submontane tropical or subtropical rainforest
- I.A.1.N.c. Montane tropical or subtropical rainforest
- I.A.1.N.d. Montane tropical or subtropical cloud forest
- I.A.1.N.e. Subalpine tropical or subtropical rainforest
- I.A.1.N.f. Temporarily flooded tropical or subtropical rainforest
- I.A.1.N.g. Semipermanently flooded tropical or subtropical rainforest
- I.A.1.N.h. Saturated tropical or subtropical evergreen rainforest
- I.A.1.N.i. Tidal tropical or subtropical rainforest
- I.A.1.N.j. Seasonally flooded tropical or subtropical rainforest

I.A.2. Temperate or subpolar broad-leaved evergreen rainforest (restricted to southern hemisphere)
- I.A.2.N.a. Temperate evergreen rainforest
- I.A.2.N.b. Subpolar evergreen rainforest
- I.A.2.N.c. Temporarily flooded temperate evergreen rainforest
- I.A.2.N.d. Seasonally flooded temperate evergreen rainforest

I.A.3. Tropical or subtropical broad-leaved seasonal evergreen forest (mainly broad-leaved evergreen trees with some foliage reduction in the dry season)
- I.A.3.N.a. Lowland tropical or subtropical seasonal evergreen forest
- I.A.3.N.b. Submontane tropical or subtropical seasonal evergreen forest
- I.A.3.N.c. Montane tropical or subtropical seasonal evergreen forest
- I.A.3.N.d. Subalpine tropical or subtropical evergreen forest
- I.A.3.N.e. Temporarily flooded tropical or subtropical seasonal evergreen forest
- I.A.3.N.f. Seasonally flooded tropical or subtropical seasonal evergreen forest
- I.A.3.N.g. Semipermanently flooded tropical or subtropical seasonal evergreen forest

I.A.4. Temperate broad-leaved seasonal evergreen forest (mainly broad-leaved evergreen with some foliage reduction in the dry season)
- I.A.4.N.a. Lowland temperate seasonal evergreen forest
- I.A.4.N.b. Submontane temperate seasonal evergreen forest
- I.A.4.N.c. Montane temperate seasonal evergreen forest
- I.A.4.N.d. Subalpine temperate evergreen forest
- I.A.4.N.e. Temporarily flooded temperate seasonal evergreen forest
- I.A.4.N.f. Seasonally flooded temperate seasonal evergreen forest
- I.A.4.N.g. Saturated temperate seasonal evergreen forest

I.A.5. Tropical or subtropical broad-leaved evergreen sclerophyllous forest.
- I.A.5.N.a. Lowland tropical or subtropical broad-leaved evergreen sclerophyllous forest
- I.A.5.N.b. Temporarily flooded tropical or subtropical broad-leaved evergreen sclerophyllous forest
- I.A.5.N.c. Seasonally flooded tropical or subtropical broad-leaved evergreen sclerophyllous forest
- I.A.5.N.d. Semipermanently flooded tropical or subtropical broad-leaved evergreen sclerophyllous forest
- I.A.5.N.e. Saturated tropical or subtropical broad-leaved evergreen sclerophyllous forest
- I.A.5.N.f. Tidal tropical or subtropical broad-leaved evergreen sclerophyllous forest (e.g., mangroves)

I.A.6. Winter-rain broad-leaved evergreen sclerophyllous forest (stiff leathery-leaved trees)
- I.A.6.N.a. Giant lowland or submontane winter-rain evergreen sclerophyllous forest (over 50 m tall, e.g. Eucalyptus in Australia)
- I.A.6.N.b. Lowland or submontane winter-rain evergreen sclerophyllous forest (under 50 m tall, e.g. live oak in California)

I.A.7. Tropical or subtropical needle-leaved evergreen forest

I.A.7.N.a. Lowland or submontane tropical or subtropical needle-leaved evergreen forest
I.A.7.N.b. Montane or subalpine tropical or subtropical needle-leaved evergreen forest
I.A.7.N.c. Temporarily flooded tropical or subtropical needle-leaved evergreen forest

I.A.8. Temperate or subpolar needle-leaved evergreen forest. (mostly needle-leaved or scale-leaved trees)
I.A.8.N.a. Giant temperate or subpolar needle-leaved evergreen forest (e.g., redwood and Douglas Fir)
I.A.8.N.b. Rounded-crowned temperate or subpolar needle-leaved evergreen forest (e.g., pines, western juniper)
I.A.8.N.c. Conical-crowned temperate or subpolar needle-leaved evergreen forest (e.g., spruce, eastern juniper, cedar)
I.A.8.N.d. Cylindrical-crowned temperate or subpolar needle-leaved evergreen forest (e.g., boreal spruce forests of Alaska)
I.A.8.N.e. Temporarily flooded temperate or subpolar needle-leaved evergreen forest
I.A.8.N.f. Seasonally flooded temperate or subpolar needle-leaved evergreen forest
I.A.8.N.g. Saturated temperate or subpolar needle-leaved evergreen forest
I.A.8.N.h. Tidal temperate or subpolar needle-leaved evergreen forest

I.A.9. Extremely xeromorphic evergreen forest
I.A.9.N.a Sclerophyllous extremely xeromorphic evergreen forest
I.A.9.N.b. Succulent extremely xeromorphic evergreen forest (assumed to be evergreen)

I.B. Deciduous forest - deciduous tree species generally contribute >75% of the total tree cover

I.B.1. Drought-deciduous forest.
I.B.1.N.a. Lowland or submontane drought-deciduous forest
I.B.1.N.b. Montane or cloud drought-deciduous forest

I.B.2. Cold-deciduous forest
I.B.2.N.a. Lowland or submontane cold-deciduous forest (e.g.,broadleaf forests of the Midwest)
I.B.2.N.b. Montane or boreal cold-deciduous forest (e.g., broadleaf forests of the mountains)
I.B.2.N.c. Subalpine or subpolar cold-deciduous forest
I.B.2.N.d. Temporarily flooded cold-deciduous forest (e.g., alluvial bottomland hardwoods)
I.B.2.N.e. Seasonally flooded cold-deciduous forest (e.g., deciduous larch forests in Alaska, peat forests)
I.B.2.N.f. Semipermanently flooded cold-deciduous forest (e.g., cypress swamp)
I.B.2.N.g. Saturated cold-deciduous forest
I.B.2.N.h. Tidal cold-deciduous forest

I.B.3 Extremely xeromorphic deciduous forest
1.B.3.N.a. Extremely xeromorphic deciduous thorn forest

1.C. Mixed evergreen-deciduous forest - evergreen and deciduous species generally contribute 25-75% of total tree cover. (Includes semi-deciduous, semi-evergreen, mixed evergreen-deciduous xeromorphic, and mixed needle-leaved evergreen-cold-deciduous woody vegetation.)

I.C.1. Tropical or subtropical semi-deciduous forest
I.C.1.N.a. Lowland tropical or subtropical semi-deciduous forest
I.C.1.N.b. Cloud or montane tropical or subtropical semi-deciduous forest
I.C.1.N.c. Seasonally flooded tropical or subtropical semi-deciduous forest
I.C.1.N.d. Saturated tropical or subtropical semi-deciduous forest

I.C.2. Mixed broad-leaved evergreen - cold-deciduous forest
I.C.2.N.a. Mixed broad-leaved evergreen - cold-deciduous forest
I.C.2.N.b. Temporarily flooded mixed evergreen - cold-deciduous forest
I.C.2.N.c. Seasonally flooded mixed broad-leaved evergreen - cold-deciduous forest
I.C.2.N.d. Saturated mixed broad-leaved evergreen - cold-deciduous forest

I.C.3. Mixed needle-leaved evergreen - cold-deciduous forest
I.C.3.N.a. Mixed needle-leaved evergreen - cold-deciduous forest

I.C.3.N.b. Temporarily flooded mixed needle-leaved evergreen - cold-deciduous forest
I.C.3.N.c. Seasonally flooded mixed needle-leaved evergreen - cold-deciduous forest
I.C.3.N.d. Saturated mixed needle-leaved evergreen - cold-deciduous forest

I.C.4 Extremely xeromorphic mixed evergreen-deciduous forest
I.C.4.N.a. Extremely xeromorphic mixed evergreen - deciduous thorn forest

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II. WOODLAND. Open stands of trees with crowns not usually touching (generally forming 25 - 60% cover). Canopy tree cover may be less than 25% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover, respectively

II.A. Evergreen woodland - evergreen species generally contribute >75% of the total tree cover

II.A.1. Tropical or subtropical broad-leaved evergreen woodland
II.A.1.N.a . Tropical or subtropical broad-leaved evergreen woodland
II.A.1.N.b . Temporarily flooded tropical or subtropical broad-leaved .....evergreen woodland
II.A.1.N.c . Seasonally flooded tropical or subtropical broad-leavedevergreen woodland
II.A.1.N.d. Semipermanently flooded tropical or subtropical broad-leaved .....evergreen woodland
II.A.1.N.e . Tidal tropical or subtropical broad-leaved evergreen woodland

II.A.2. Temperate broad-leaved evergreen woodland
II.A.2.N.a . Temperate broad-leaved evergreen woodland
II.A.2.N.b . Seasonally flooded temperate broad-leaved evergreen woodland
II.A.2.N.c . Saturated temperate broad-leaved evergreen woodland

II.A.3. Tropical or subtropical needle-leaved evergreen woodland
II.A.3.N.a . Tropical or subtropical needle-leaved evergreen woodland
II.A.3.N.b . Temporarily flooded tropical or subtropical needle-leaved evergreen woodland
II.A.3.N.c . Seasonally flooded tropical or subtropical needle-leaved evergreen woodland
II.A.3.N.d . Saturated tropical or subtropical needle-leaved evergreen woodland

II.A.4. Temperate or subpolar needle-leaved evergreen woodland
II.A.4.N.a . Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (e.g., pine, Western juniper)
II.A.4.N.b . Conical-crowned temperate or subpolar needle-leaved evergreen woodland (e.g., spruce in the west)
II.A.4.N.c . Cylindrical-crowned temperate or subpolar needle-leaved evergreen woodland (e.g., some spruce in Alaska)
II.A.4.N.d . Temporarily flooded temperate or subpolar needle-leaved evergreen woodland
II.A.4.N.e . Seasonally flooded temperate or subpolar needle-leaved evergreen woodland
II.A.4.N.f . Saturated temperate or subpolar needle-leaved evergreen woodland (e.g., black spruce bogs)

II.A.5. Extremely xeromorphic evergreen woodland
II.A.5.N.a . Sclerophyllous extremely xeromorphic evergreen woodland
II.A.5.N.b . Succulent extremely xeromorphic evergreen woodland

II.B. Deciduous woodland - deciduous tree species generally contribute to >75% of the total tree cover

II.B.1. Tropical or subtropical drought-deciduous woodland
II.B.1.N.a . Lowland or submontane broad-leaved drought-deciduous woodland
II.B.1.N.b . Montane (and cloud) drought-deciduous woodland
II.B.1.N.c . Temporarily flooded tropical or subtropical drought-deciduous woodland
II.B.1.N.d . Seasonally flooded tropical or subtropical drought-deciduous woodland

II.B.2. Cold-deciduous woodland
II.B.2.N.a . Cold-deciduous woodland
II.B.2.N.b . Temporarily flooded cold-deciduous woodland
II.B.2.N.c . Seasonally flooded cold-deciduous woodland
II.B.2.N.d . Semipermanently flooded cold-deciduous woodland

II.B.2.N.e . Saturated cold-deciduous woodland
II.B.2.Nf. Tidal cold-deciduous woodland

II.B.3. Extremely xeromorphic deciduous woodland
II.B.3.N.a Thorn extremely xeromorphic deciduous woodland (may not be represented in the U.S.)

II.C. Mixed evergreen-deciduous woodland - evergreen and deciduous species each contribute 25-75% of total tree cover. (Includes semi-deciduous, semi-evergreen, mixed evergreen-deciduous xeromorphic, and mixed needle-leaved evergreen cold-deciduous woody vegetation.)

II.C.1. Tropical or subtropical semi-deciduous woodland
II.C.1.N.a . Tropical or subtropical semi-deciduous woodland

II.C.2. Mixed broad-leaved evergreen - cold-deciduous woodland
II.C.2.N.a . Mixed broad-leaved evergreen - cold-deciduous woodland

II.C.3. Mixed needle-leaved evergreen - cold-deciduous woodland
II.C.3.N.a . Mixed needle-leaved evergreen - cold-deciduous woodland
II.C.3.N.b . Seasonally flooded mixed needle-leaved evergreen cold-deciduous woodland
II.C.3.N.c . Saturated mixed needle-leaved evergreen cold-deciduous woodland

II.C.4. Extremely xeromorphic mixed evergreen-deciduous woodland
II.C.4.N.a . Mixed evergreen-deciduous thorn woodland

III. SHRUBLAND. Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less than 25% cover). Shrub cover may be less than 25% where it exceeds tree, dwarf-shrub, herb, and nonvascular cover, respectively.Vegetation dominated by woody vines is generally treated in this class

III.A. Evergreen shrubland - evergreen species generally contribute >75% of the total shrub cover

III.A.1. Tropical or subtropical broad-leaved evergreen shrubland (with or without scattered tree canopy)
III.A.1.N.a. Tropical or subtropical broad-leaved evergreen shrubland (includes bamboos and tuft-trees)
III.A.1.N.b. Hemi-sclerophyllous tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.c. Sclerophyllous tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.d. Tropical or subtropical broad-leaved evergreen shrubland with a sparse broad-leaved evergreen tree layer (includes tuft trees)
III.A.1.N.e. Temporarily flooded tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.f. Seasonally flooded tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.g. Semipermanently flooded tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.h. Saturated tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.i. Tidal tropical or subtropical broad-leaved evergreen shrubland

III.A.2. Temperate broad-leaved evergreen shrubland (with or without scattered tree canopy)
III.A.2.N.a. Temperate broad-leaved evergreen shrubland (including bamboos and tuft-trees)
III.A.2.N.b. Hemi-sclerophyllous temperate broad-leaved evergreen shrubland
III.A.2.N.c. Sclerophyllous temperate broad-leaved evergreen shrubland
III.A.2.N.d. Suffruticose temperate broad-leaved evergreen shrubland
III.A.2.N.e. Temperate broad-leaved evergreen shrubland with a sparse broad-leaved evergreen tree layer (includes tuft trees)
III.A.2.N.f. Temperate broad-leaved evergreen shrubland with a sparse cold-deciduous tree layer
III.A.2.N.g. Temporarily flooded temperate broad-leaved evergreen shrubland
III.A.2.N.h. Seasonally flooded temperate broad-leaved evergreen shrubland
III.A.2.N.i. Saturated temperate broad-leaved evergreen shrubland
III.A.2.N.j. Saturated temperate broad-leaved evergreen shrubland with a sparse needle-leaved or mixed evergreen tree layer (e.g., pocosins)
III.A.2.N.k. Saturated temperate broad-leaved evergreen shrubland with a sparse cold-deciduous tree layer
III.A.2.N.l. Tidal broad-leaved evergreen temperate shrubland

III.A.3. Needle-leaved evergreen shrubland
- III.A.3.N.a. Needle-leaved evergreen shrubland (e.g., krummholz)
- III.A.3.N.b. Saturated needle-leaved evergreen shrubland (e.g., shrub bog)

III.A.4. Microphyllous evergreen shrubland
- III.A.4.N.a. Microphyllous evergreen shrubland (e.g., sagebrush)
- III.A.4.N.b. Intermittently flooded microphyllous shrubland
- III.A.4.N.c. Temporarily flooded microphyllous shrubland
- III.A.4.N.d. Seasonally flooded microphyllous shrubland

III.A.5. Extremely xeromorphic evergreen shrubland
- III.A.5.N.a. Broad-leaved and microphyllous evergreen extremely xeromorphic subdesert shrubland (e.g., creosote bush)
- III.A.5.N.b. Facultatively deciduous extremely xeromorphic subdesert shrubland (e.g., saltbush)
- III.A.5.N.c. Succulent extremely xeromorphic evergreen shrubland
- III.A.5.N.d. Tidal extremely xeromorphic shrubland
- III.A.5.N.e. Extremely xeromorphic evergreen shrubland with a sparse tree layer

III.B. Deciduous shrubland - deciduous species generally contribute >75% of the total shrub cover

III.B.1. Drought-deciduous shrubland
- III.B.1.N.a. Lowland drought-deciduous shrubland

III.B.2. Cold-deciduous shrubland
- III.B.2.N.a. Temperate cold-deciduous shrubland (e.g., serviceberry, some oaks)
- III.B.2.N.b. Subalpine or subpolar cold-deciduous shrubland (e.g., willow, alder)
- III.B.2.N.c. Intermittently flooded cold-deciduous shrubland
- III.B.2.N.d. Temporarily flooded cold-deciduous shrubland
- III.B.2.N.e. Seasonally flooded cold-deciduous shrubland (e.g.,blueberry-azalea thickets)
- III.B.2.N.f. Semipermanently flooded cold-deciduous shrubland (e.g., buttonbush thickets)
- III.B.2.N.g. Saturated cold-deciduous shrubland (e.g., on peat)
- III.B.2.N.h. Tidal cold-deciduous shrubland (e.g., high tide bush)

III.B.3. Extremely xeromorphic deciduous shrubland
- III.B.3.N.a. Extremely xeromorphic deciduous subdesert shrubland without succulents
- III.B.3.N.b. Intermittently flooded extremely xeromorphic deciduous subdesert shrubland

III.C. Mixed evergreen-deciduous shrubland - evergreen and deciduous species each generally contribute 25-75% of total shrub cover (includes facultatively deciduous, extremely xeromorphic mixed evergreen-deciduous woody plants)

III.C.1. Mixed evergreen - drought-deciduous shrubland
- III.C.1.N.a. Lowland mixed evergreen - drought-deciduous shrubland

III.C.2. Mixed evergreen - cold-deciduous shrubland (with or without scattered tree canopy)
- III.C.2.N.a. Mixed evergreen - cold-deciduous shrubland
- III.C.2.N.b. Mixed evergreen - cold-deciduous shrubland with a sparse needle-leaved evergreen tree layer (e.g., pitch pine-scrub oak)
- III.C.2.N.c. Intermittently flooded mixed evergreen - cold-deciduous shrubland
- III.C.2.N.d. Seasonally flooded mixed evergreen - cold-deciduous shrubland
- III.C.2.N.e. Saturated mixed evergreen - cold-deciduous shrubland (e.g., on peat)
- III.C.2.N.f. Saturated mixed evergreen - cold-deciduous shrubland with a sparse needle-leaved evergreen tree layer (e.g., pocosins)

III.C.3. Extremely xeromorphic mixed evergreen-deciduous shrubland

III.C.3.N.a. Extremely xeromorphic deciduous subdesert shrubland with succulents (e.g. palo verde)
III.C.3.N.b. Mixed evergreen - deciduous subdesert shrubland

IV. DWARF-SHRUBLAND. Low-growing shrubs usually under 0.5 m tall. Individuals or clumps overlapping to not touching (generally forming morethan 25% cover, trees and tall shrubs generally less than 25% cover). Dwarf-shrubcover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover, respectively

IV.A. Evergreen dwarf-shrubland - evergreen species generally contribute >75% of the total dwarf-shrub cover

IV.A.1. Needle-leaved or microphyllous evergreen dwarf-shrubland (with or without scattered tree canopy)
IV.A.1.N.a. Caespitose needle-leaved or microphyllous evergreen dwarf-shrubland (e.g., alpine azalea)
IV.A.1.N.b. Creeping or matted needle-leaved or microphyllous evergreen dwarf-shrubland
IV.A.1.N.c. Cushion needle-leaved or microphyllous evergreen dwarf-shrubland
IV.A.1.N.d. Needle-leaved or microphyllous evergreen dwarf-shrubland with a sparse needle-leaved evergreen tree layer
IV.A.1.N.e. Temporarily flooded needle-leaved and microphyllous evergreen dwarf-shrubland
IV.A.1.N.f. Seasonally flooded needle-leaved and microphyllous evergreen dwarf-shrubland
IV.A.1.N.g. Saturated needle-leaved or microphyllous evergreen dwarf-shrubland (may include sparse dwarf-shrubland, e.g., dwarf-shrub bogs)
IV.A.1.N.h. Saturated needle-leaved or microphyllous evergreen dwarf-shrubland with a sparse needle-leaved evergreen tree layer

IV.A.2. Extremely xeromorphic evergreen dwarf-shrubland
IV.A.2.N.a. Extremely xeromorphic evergreen subdesert dwarf-shrubland
IV.A.2.N.b. Facultatively deciduous subdesert dwarf-shrubland
IV.A.2.N.c. Tidal needle-leaved or microphyllous evergreen dwarf-shrubland

IV.B. Deciduous dwarf-shrubland - deciduous species generally contribute >75% of the total dwarf-shrub cover

IV.B.1. Drought-deciduous dwarf-shrubland
IV.B.1.N.a. Caespitose drought-deciduous dwarf-shrubland
IV.B.1.N.b. Creeping or matted drought-deciduous dwarf-shrubland
IV.B.1.N.c. Cushion drought-deciduous dwarf-shrubland

IV.B.2. Cold-deciduous dwarf-shrubland
IV.B.2.N.a. Caespitose cold-deciduous dwarf-shrubland
IV.B.2.N.b. Creeping or matted cold-deciduous dwarf-shrubland
IV.B.2.N.c. Cushion cold-deciduous dwarf-shrubland
IV.B.2.N.d. Saturated cold-deciduous dwarf-shrubland

IV.B.3. Extremely xeromorphic deciduous dwarf-shrubland
IV.B.3.N.a. Extremely xeromorphic deciduous subdesert dwarf-shrubland without succulents

IV.C. Mixed evergreen-deciduous dwarf-shrubland - evergreen and deciduous species each generally contribute 25% dwarf-shrub cover.(Includes facultatively deciduous shrubs and other mixed xeromorphic evergreen-deciduous shrubs)

IV.C.1. Mixed evergreen - drought-deciduous dwarf-shrubland
IV.C.1.N.a. Mixed evergreen - drought-deciduous dwarf-shrubland

IV.C.2. Mixed evergreen- cold-deciduous dwarf-shrubland
IV.C.2.N.a. Mixed evergreen - cold-deciduous dwarf-shrubland

IV.C.3. Extremely xeromorphic mixed evergreen - deciduous dwarf-shrubland
IV.C.3.N.a. Deciduous subdesert dwarf-shrubland with succulents
IV.C.3.N.b. Mixed evergreen - deciduous subdesert dwarf-shrubland

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V. HERBACEOUS. Herbs (graminoids, forbs, and ferns) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 25% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover, respectively

V.A. Perennial graminoid vegetation (grasslands). Perennial graminoids generally contribute to greater than 50% of total herbaceous canopy cover when the cover of each of the the other life forms present (i.e. tree, shrub, dwarf-shrub, nonvascular) is less than 25% and herbaceous cover exceeds the cover of the other life forms

V.A.1. Tropical or subtropical grassland
V.A.1.N.a . Tall tropical or subtropical grassland
V.A.1.N.b . Medium-tall sod tropical or subtropical grassland
V.A.1.N.c . Medium-tall bunch tropical or subtropical grassland
V.A.1.N.d . Short sod tropical or subtropical grassland
V.A.1.N.e . Short bunch tropical alpine grassland (e.g., Super-paramo)
V.A.1.N.f . Temporarily flooded tropical or subtropical grassland
V.A.1.N.g . Seasonally flooded tropical or subtropical grassland
V.A.1.N.h . Semipermanently flooded tropical or subtropical grassland
V.A.1.N.i. Tidal tropical or subtropical grassland

V.A.2. Tropical or subtropical grassland with a sparse tree layer
V.A.2.N.a. Tall tropical or subtropical grassland with a sparse mainly broad-leaved evergreen tree layer (includes tuft plants and broad-leaved semi-evergreen trees)
V.A.2.N.b. Tall tropical or subtropical grassland with a sparse broad-leaved drought-deciduous tree layer
V.A.2.N.c. Medium-tall tropical or subtropical grassland with a sparse broad-leaved evergreen tree layer (includes tuft plants and semi-evergreen trees)
V.A.2.N.d . Medium-tall tropical or subtropical grassland with a sparse broad-leaved drought-deciduous tree layer
V.A.2.N.e. Medium-tall tropical or subtropical grassland with a sparse needle-leaved evergreen or mixed tree layer
V.A.2.N.f . Medium-tall tropical or subtropical grassland with a sparse xeromorphic or succulent tree layer
V.A.2.N.g. Temporarily flooded tropical grassland with a sparse broad-leaved evergreen tree layer (includes tuft plants, e.g., Llanos de Mojos, Bolivia)
V.A.2.N.h. Temporarily flooded tropical grassland with a sparse broad-leaved deciduous tree layer (e.g. in Northeast Bolivia)
V.A.2.N.i. Seasonally flooded tropical or subtropical grassland with a sparse needle-leaved evergreen tree layer
V.A.2.N.j. Seasonally flooded tropical or subtropical grassland with a sparse needle-leaved deciduous tree layer

V.A.3. Tropical or subtropical grassland with a sparse shrub layer
V.A.3.N.a . Tall tropical or subtropical grassland with a sparse broad-leaved evergreen or semi-evergreen shrub layer (includes tuft shrubs)
V.A.3.N.b. Tall tropical or subtropical grassland with a sparse broad-leaved drought-deciduous shrub layer
V.A.3.N.c. Medium-tall tropical or subtropical grassland with a sparse broad-leaved evergreen or semi-evergreen shrub layer (includes tuft plants)
V.A.3.N.d. Medium-tall tropical or subtropical grassland with a sparse drought-deciduous shrub layer
V.A.3.N.e. Medium-tall tropical or subtropical grassland with a sparse xeromorphic (often thorny) shrub layer
V.A.3.N.f. Short tropical or subtropical grassland with a sparse broad-leaved evergreen or semi-evergreen shrub layer (includes tuft plants, e.g., Paramo)

V.A.3.N.g. Short tropical or subtropical grassland with a sparse drought-deciduous shrub layer (includes thorny shrubs)
V.A.3.N.h. Short alpine bunch tropical or subtropical grassland with a sparse evergreen shrub layer
V.A.3.N.i. Temporarily flooded tropical or subtropical grassland with a sparse evergreen broad-leaved shrub layer

V.A.4. Tropical or subtropical grassland with a sparse dwarf-shrub layer
V.A.4.N.a. Short bunch tropical or subtropical grassland with a sparse needle-leaved or microphyllous evergreen dwarf-shrub layer (e.g., Puna)

V.A.5. Temperate or subpolar grassland
V.A.5.N.a. Tall sod temperate grassland (includes sod or mixed sod-bunch graminoids)
V.A.5.N.b. Tall bunch temperate grassland
V.A.5.N.c. Medium-tall sod temperate or subpolar grassland (includes sod or mixed sod-bunch graminoids)
V.A.5.N.d. Medium-tall bunch temperate or subpolar grassland
V.A.5.N.e. Short sod temperate or subpolar grassland (includes sod or mixedsod-bunch graminoids, e.g. shortgrass prairie)
V.A.5.N.f. Short bunch temperate or subpolar grassland
V.A.5.N.g. Short alpine or subalpine sod grassland
V.A.5.N.h. Short alpine or subalpine dry bunch grassland
V.A.5.N.i. Intermittently flooded temperate or subpolar grassland (e.g., playa lakes)
V.A.5.N.j. Temporarily flooded temperate or subpolar grassland
V.A.5.N.k. Seasonally flooded temperate or subpolar grassland
V.A.5.N.l. Semipermanently flooded temperate or subpolar grassland
V.A.5.N.m. Saturated temperate or subpolar grassland
V.A.5.N.n. Tidal temperate or subpolar grassland

V.A.6. Temperate or subpolar grassland with a sparse tree layer
V.A.6.N.a. Tall temperate grassland with a sparse broad-leaved evergreen tree layer
V.A.6.N.b. Tall temperate grassland with a sparse needle-leaved evergreen tree layer
V.A.6.N.c. Tall temperate grassland with a sparse cold-deciduous tree layer
V.A.6.N.d. Tall temperate grassland with a sparse mixed needle-leaved evergreen or cold-deciduous tree layer
V.A.6.N.e. Medium-tall temperate grassland with a sparse broad-leaved evergreen or semi-evergreen tree layer (includes tuft plants)
V.A.6.N.f. Medium-tall temperate or subpolar grassland with a sparse needle-leaved evergreen or mixed tree layer
V.A.6.N.g. Medium-tall temperate or subpolar grassland with a sparse cold-deciduous tree layer
V.A.6.N.h. Short temperate or subpolar grassland with a sparse broad-leaved evergreen or semi-evergreen tree layer
V.A.6.N.i. Short temperate or subpolar grassland with a sparse cold-deciduous tree layer
V.A.6.N.j. Intermittently flooded temperate or subpolar grassland with sparse needle-leaved evergreen tree layer
V.A.6.N.k. Temporarily flooded temperate or subpolar grassland with a sparse broad-leaved evergreen tree layer
V.A.6.N.l. Temporarily flooded temperate or subpolar grassland with a sparse cold-deciduous tree layer
V.A.6.N.m. Seasonally flooded temperate or subpolar grassland with a sparse cold-deciduous tree layer
V.A.6.N.n. Semipermanently flooded temperate or subpolar grassland with a sparse cold-deciduous tree layer
V.A.6.N.o. Saturated temperate or subpolar grassland with a sparse needle-leaved evergreen tree layer
V.A.6.N.p. Tidal temperate grassland with a sparse cold-deciduous tree layer

V.A.7. Temperate or subpolar grassland with a sparse shrub layer
V.A.7.N.a. Tall temperate grassland with a sparse broad-leaved evergreen shrub layer (includes tuft shrubs)
V.A.7.N.b. Tall temperate grassland with a sparse microphyllous evergreen shrub layer
V.A.7.N.c. Tall temperate grassland with a sparse cold-deciduous shrub layer
V.A.7.N.d. Medium-tall temperate or subpolar grassland with a sparse broad-leaved evergreen shrub layer
V.A.7.N.e. Medium-tall temperate or subpolar grassland with a sparse needle-leaved or microphyllous evergreen shrub layer
V.A.7.N.f. Medium-tall temperate or subpolar grassland with a sparse drought-deciduous shrub layer
V.A.7.N.g. Medium-tall temperate or subpolar grassland with a sparse cold-deciduous shrub layer
V.A.7.N.h. Medium-tall temperate grassland with a sparse xeromorphic ..... (often thorny) shrub layer

V.A.7.N.i. Short temperate or subpolar grassland with a sparse broad-leaved evergreen or semi-evergreen shrub layer
V.A.7.N.j. Short temperate or subpolar grassland with a sparse microphyllous evergreen shrub layer
V.A.7.N.k. Short temperate or subpolar grassland with a sparse drought-deciduous shrub layer (includes thorny shrubs)
V.A.7.N.l. Short temperate or subpolar grassland with a sparse cold-deciduous shrub layer
V.A.7.N.m. Short temperate or subpolar grassland with a sparse xeromorphic (evergreen and/or deciduous) shrub layer
V.A.7.N.n. Intermittently flooded temperate or subpolar grassland with a sparse xeromorphic (evergreen and/or deciduous) shrub layer
V.A.7.N.o . Saturated temperate or subpolar grassland with a sparse broad-leaved evergreen shrub layer
V.A.7.N.p . Saturated temperate or subpolar grassland with a sparse cold-deciduous shrub layer
V.A.7.N.q. Saturated temperate or subpolar grassland with a sparse microphyllous evergreen shrub layer

V.A.8. Temperate or subpolar grassland with a sparse dwarf-shrub layer
VA.8.N.a. Short temperate or subpolar lowland grassland with a sparse needle-leaved or microphyllous dwarf shrub layer
V.A.8.n.b. Short temperate or subpolar lowland grassland with a sparse cold-deciduous dwarf shrub layer
V.A.8.N.c. Short temperate or subpolar alpine grassland with a sparse needle-leaved or microphyllous evergreen dwarf-shrub layer (e.g., dwarf-shrub meadows)
V.A.8.N.d. Seasonally flooded temperate or subpolar grassland with a sparse needle-leaved or microphyllous dwarf-shrub layer

V.A.9. Polar grassland
V.A.9.N.a. Short sod polar grassland (including sod or mixed sod-bunch grassland, e.g., sod grass tundra)
V.A.9.N.b. Short bunch polar grassland (e.g. Eriophorum)
V.A.9.N.c. Seasonally flooded polar grassland
V.A.9.N.d. Saturated polar grassland with nonvascular plants admixed

V.A.10. Polar grassland with a sparse shrub layer

V.A.11. Polar grassland with a sparse dwarf-shrub layer

V.B. Perennial forb vegetation. Perennial forbs (including ferns and biennials) generally contributing to greater than 50% of total herbaceous canopy cover

V.B.1. Tropical or subtropical perennial forb vegetation
V.B.1.N.a. Tall tropical or subtropical perennial forb vegetation
V.B.1.N.b. Low tropical or subtropical perennial forb vegetation
V.B.1.N.c. Semipermanently flooded tropical or subtropical perennial forb vegetation
V.B.1.N.d. Saturated tropical or subtropical perennial forb vegetation
V.B.1.N.e. Tidal tropical or subtropical perennial forb vegetation

V.B.2. Temperate or subpolar perennial forb vegetation
V.B.2.N.a. Tall temperate or subpolar perennial forb vegetation (e.g., tall forb meadows)
V.B.2.N.b. Low temperate or subpolar perennial forb vegetation (e.g.,Aleutian forb meadows)
V.B.2.N.c. Intermittently flooded temperate perennial forb vegetation
V.B.2.N.d. Temporarily flooded temperate perennial forb vegetation
V.B.2.N.e. Semipermanently flooded temperate perennial forb vegetation
V.B.2.N.f. Saturated temperate perennial forb vegetation
V.B.2.N.g. Tidal temperate perennial forb vegetation
V.B.2.N.h. Seasonally flooded temperate perennial forb vegetation

V.C. Hydromorphic rooted vegetation. Non-emergent graminoids or forbs structurally supported by water and rooted in substrate (e.g., pond weeds and water lilies)

V.C.1. Tropical or subtropical hydromorphic rooted vegetation (without seasonal contrasts)

V.C.1.N.a. Permanently flooded tropical or subtropical hydromorphic rooted vegetation
V.C.1.N.b. Permanently flooded-tidal tropical or subtropical hydromorphic rooted vegetation (e.g., tropical seagrass beds)

V.C.2. Temperate or subpolar hydromorphic rooted vegetation
V.C.2.N.a. Permanently flooded temperate or subpolar hydromorphic rooted vegetation
V.C.2.N.b. Permanently flooded-tidal temperate or subpolar hydromorphic rooted vegetation (e.g., temperate seagrass beds)

V.D. Annual graminoid or forb vegetation

V.D.1. Tropical or subtropical annual grasslands or forb vegetation
V.D.1.N.a. Tropical or subtropical annual grasslands
V.D.1.N.b. Tall tropical or subtropical annual forb vegetation
V.D.1.N.c. Low tropical or subtropical ephemeral annual forb vegetation
V.D.1.N.d. Tidal tropical or subtropical annual forb vegetation

V.D.2. Temperate or subpolar annual grasslands or forb vegetation
V.D.2.N.a. Tall temperate or subpolar annual grassland (dominated by annual graminoids)
V.D.2.N.b. Tall temperate or subpolar annual forb vegetation (dominated by annual forbs)
V.D.2.N.c. Low desert or subdesert ephemeral or episodic annual forb vegetation
V.D.2.N.d. Short temperate annual grassland
V.D.2.N.e. Low temperate intermittently exposed annual forb vegetation
V.D.2.N.f. Temporarily flooded temperate annual forb vegetation
V.D.2.N.g. Seasonally flooded temperate annual grassland
V.D.2.N.h. Seasonally flooded temperate annual forb vegetation
V.D.2.N.i. Saturated temperate annual forb vegetation

VI . NONVASCULAR. Nonvascular cover (bryophytes, non-crustose lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and herb cover, respectively

VI.A. Bryophyte vegetation. Bryophytes generally dominate the nonvascular cover

VI.A.1. Temperate or subpolar bryophyte vegetation
VI.A.1.N.a. Lowland bryophyte vegetation
VI.A.1.N.b. Seasonally flooded bryophyte vegetation
VI.A.1.N.c. Saturated bryophyte vegetation
VI.A.1.N.d. Saturated bryophyte vegetation with a sparse tree layer (e.g., treed bogs)
VI.A.1.N.e. Saturated bryophyte vegetation with a sparse dwarf-shrub layer (e.g., dwarf-shrub/moss tundra)

VI.B. Lichen vegetation. Lichens (foliose or fruticose) generally dominate the nonvascular cover

VI.B.1. Temperate or subpolar lichen vegetation
VI.B.1.N.a. Lowland lichen vegetation
VI.B.1.N.b. Montane/submontane temperate or subpolar lichen vegetation dominate the nonvascular cover
VI.B.1.N.c. Lichen vegetation with a sparse tree layer
VI.B.1.N.d. Lichen vegetation with a sparse dwarf-shrub layer

VI.B.2. Tropical or subtropical lichen vegetation
VI.B.2.N.a. Montane/submontane tropical or subtropical lichen vegetation

VI.C. Alga vegetation. Algae generally dominate the nonvascular cover

VI.C.1. Tropical or subtropical alga vegetation
VI.C.1.N.a. Seasonally flooded alga vegetation

VII. SPARSE VEGETATION. Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 25% and greater than 0%)

VII.A. Consolidated rock sparse vegetation (cliffs, pavement, incl. lava flows). (Vegetation characterized by herbs, shrubs, trees, and/or nonvascular plants growing in fissures of rocks or walls, or growing adnate on these surfaces.)

VII.A.1. Sparsely vegetated cliffs
- VII.A.1.N.a. Cliffs with sparse vascular vegetation (e.g., bromeliads in neotropics). (May have sparse to dense crustose lichens, sparse bryoids or foliose or fruticose lichens)

VII.A.2. Sparsely vegetated pavement. (level/gently sloping bedrock)
- VII.A.2.N.a. Pavement with sparse vascular vegetation (May have sparse to dense crustose lichens, sparse bryoids, or foliose or fruticose lichens)

VII.B. Boulder, gravel, cobble, or talus sparse vegetation (incuding a'a lava flows). (Vegetation generally characterized by herbs, and occasionally shrubs and trees on gravel or cobble substrates. Lichens are also common.)

VII.B.1. Sparsely vegetated talus/scree slopes
- VII.B.1.N.a. Lowland or submontane talus/scree
- VII.B.1.N.b. Montane talus/scree
- VII.B.1.N.c. High mountain talus/scree

VII.B.2. Sparsely vegetated rock flats. (boulders, cobble, or gravel)
- VII.B.2.N.a. Boulder fields
- VII.B.2.N.b. Cobble/gravel beaches and shores
- VIIB.2.N.c. Cobble/gravel flats and ridges

VII.C. Unconsolidated material sparse vegetation (soil, sand, and ash). (Vegetation generally characterized by isolated herbs or occasionally shrubs.)

VII.C.1. Sparsely vegetated sand dunes
- VII.C.1.N.a. Dunes with sparse herbaceous vegetation
- VII.C.1.N.b. Dunes with sparse woody vegetation

VII.C.2. Sparsely vegetated sand flats
- VII.C.2.N.a. Sand flats (including storm-washed beaches)
- VII.C.2.N.b. Intermittently flooded sand beaches and shores
- VII.C.2.N.c. Temporarily flooded sand flats
- VII.C.2.N.d. Tidal sand flats (e.g., salt pannes)

VII.C.3. Sparsely vegetated soil slopes
- VII.C.3.N.a. Moist slopes
- VII.C.3.N.b. Dry slopes

VII.C.4. Sparsely vegetated soil flats
- VII.C.4.N.a. Soil slumps or landslides
- VII.C.4.N.b. Intermittently flooded mud flats (e.g., playa lakes)
- VII.C.4.N.c. Seasonally / temporarily flooded mud flats
- VII.C.4.N.d. Tidal mud flats

VII.C.5. Sparsely vegetated ash deposits

The following terms and definitions are used in the National Vegetation Classification Standard:

Agricultural Field - Bare Soil, Crop Residue - Cropland, either tilled or untilled, which has little or no live crop vegetation present. Such areas may or may not have crop residue from previous crops on the surface. This category also includes cropland in a fallow state -- that is, cropland which has been left idle during the whole or greater portion of the growing season.

Alliance - A physiognomically uniform group of Associations sharing one or more diagnostic (dominant, differential, indicator, or character) species which, as a rule, are found in the uppermost stratum of the vegetation.

Alluvial - Characterized by the deposition of sediment by a stream or other running water at any point along its course.

Alpine - The zone on mountain tops between permanent snow and the cold limits of trees.

Annual - Plant species that complete their life-cycle within a single growing season.

Annual Close-Grown Forbs and Grasses - Annual (non-perennial) forbs and grasses which are drill-seeded or broadcast. Examples include wheat, barley, and oats.

Annual Row-Crop Forbs and Grasses - Annual (non-perennial) forbs and grasses planted in rows on a regular and generally consistent row and plant spacing. Examples include corn, soybeans, tomatoes, potatoes, sorghum, and cotton.

Annual Vegetation - Associations that persist for less than one year or are dominated by annual species.

Assemblages - Vegetative communities composed of several to many different species of plants that assemble themselves based on specific site conditions and the presence of seed.

Association - The finest level of the classification standard. The Association is a physiognomically uniform group of vegetation stands that share one or more diagnostic (dominant, differential, indicator, or character) overstory and understory species. These elements occur as repeatable patterns of assemblages across the landscape, and are generally found under similar habitat conditions. (The Association refers to existing vegetation, not a potential vegetation type).

Biennial - Plant species that complete their life-cycles within two growing seasons.

Boreal - Northern biogeographical region typically referring to subpolar and cold temperate areas.

Brackish - Tidal water with a salinity of 0.5-30 parts per thousand.

Broad-leaved - A plant with leaves that have well-defined leaf blades and are relatively wide in outline (shape) as opposed to needle-like or linear; leaf area is typically greater than 500 square millimeters or 1 square inch. **Bryophyte** - Nonvascular, terrestrial green plant, including mosses, hornworts, and liverworts.

Bunch Grass - Multi-stemmed (caespitose) life form of grasses characterized by clumps of erect shoots that slowly spread horizontally by tillers, generally creating distinct individual plants spaced across the ground; often applied to sedges and other graminoids with similar life forms.

Caespitose (cespitose) - Describes a low branching pattern from near the base that forms a multi-stemmed or a bunched appearance.

Canopy Cover - The proportion of ground, usually expressed as a percentage, that is occupied by the perpendicular projection down on to it of the aerial parts of the vegetation or the species under consideration. The additive cover of multiple strata or species may exceed 100%.

Canopy Stratum - Canopy layer.

Classification - The grouping of similar types (in this case - vegetation) according to criteria (in this case - physiognomic and floristic) which are considered significant for this purpose. The rules for classification must be clarified prior to identification of the types within the classification standard. The classification methods should be clear, precise, where possible quantitative, and based upon objective criteria, so that the outcome would be the same whoever performs the definition (or description). Classification necessarily involves definition of class boundaries (UNEP/FAO 1995).

Cliff - Any high, very steep to perpendicular, or overhanging face of a rock outcrop.

Closed Tree Canopy - A class of vegetation that is dominated by trees with interlocking crowns (generally forming 60-100% crown cover).

Cloud Forest - Tropical and subtropical montane forest characterized by a high incidence of low-level cloud cover, usually at the canopy level, promoting development of an abundance of vascular epiphytes.

Cold Deciduous - A class of vegetation where the leaves drop in the unfavorable season of winter frost and freeze. The foliage is dropped every year. Applied to vegetation adapted to cold season influences (temperate).

Conical-crowned - Describes a needle-leaved evergreen tree with a pyramidal or cone-shaped canopy or life form; for example, Douglas fir and silver fir (Pseudotsuga menziesii and Abies amabilis).

Cover - The area of ground covered by the vertical projection of the aerial parts of plants of one or more species.

Cover Type - A designation based upon the plant species forming a plurality of composition within a given area (e.g., Oak-Hickory).

Creeping - The pattern of stems growing at or just beneath the surface of the ground and usually producing roots at nodes.

Crosswalk - Organizational and definitional property of a classification standard which provides that all its categories either share a common definition with an FGDC vegetation standard category at some level of the hierarchy, or represent a subset of one and only one category at a given level of the FGDC Vegetation Classification Standard. When a standard crosswalks with the FGDC Vegetation Classification, it means that all categories of the standard have one and only one place with the FGDC Standard where they logically exist. It does not mean that all categories of the standard must crosswalk to the same level of the FGDC Standard.

Crustose Lichen - Lichen life form that grows in intimate contact with its substrate, lacks a lower cortex and rhizoids (root-like structures), and is impossible to separate from the substrate without destroying the thallus; lichen with an unlobed, flattened thallus, growing adnate to the substrate.

Cushion Plant - A low, woody, plant life form so densely branched that it forms a compact canopy that is pad- or bolster-like in appearance; usually with microphyllous foliage; characteristic of alpine and tundra plants.

Cylindrical-crowned - A needle-leaved evergreen tree with a narrow, essentially cylinder-shaped canopy or life form; for example, subalpine fir and black spruce (Abies lasiocarpa and Picea mariana).

Deciduous - A woody plant that seasonally loses all of its leaves and becomes temporarily bare-stemmed.

Deciduous Cover - Vegetation classes where 75% or more of the diagnostic vegetation is made up of tree or shrub species that shed foliage simultaneously in response to an unfavorable season. There is usually one "leaf-off" season every year.

Deciduous Vegetation - Associations in which deciduous woody plants generally contribute 75% or more to total dominant plant cover.

Diagnostic Species - a.k.a. indicator species or phytometers. Used to evaluate [i.e., diagnose] an area, or site, for some characteristic. For example, the presence and relative density of a Vaccinium stamineum var. stamineum (gooseberry) understory existing beneath a canopy of chestnut oak, black oak, and Virginia pine indicates that the site is xeric (or dry). The oaks and pines can inhabit a wide range of sites, wet to dry. But the gooseberry understory is the indicator of a drier habitat (which is probably due to a combination of factors including: soil type, slope, aspect, elevation, and site history).

Division - This is the first level in the classification standard separating Earth cover into either vegetated or non-vegetated categories (See also Order)

Dominance - The extent to which a given species or life form predominates in a community because of its size, abundance or cover, and affects the fitness of associated species. Dominance is interpreted in two different ways for vegetation classification purposes:

100% 25% 0% |----------|- - - - - - - - - - -|

Where one or more vegetation strata (life form) covers greater than 25% (represented by the ---- line), the life form greater than 25% which constitutes the uppermost canopy is referred to as the dominant life form.

100% 25% 0% |- |----------|

Where no vegetation life form covers greater than 25% (represented by the - - - line), the life form with the highest percent canopy cover is referred to as the dominant life form. In the case of a 'tie', the upper canopy will be referred to as the dominant life form.

Dominant - An organism, group of organisms, or taxon that by its size, abundance, or coverage exerts considerable influence upon an association's biotic (such as structure and function) and abiotic (such as shade and relative humidity) conditions.

Dominant Vegetation Stratum - see Canopy Stratum (above).

Drought Deciduous - Vegetation where the leaves drop in response to an annual unfavorable season characterized by drought. The foliage is dropped every year. Applied to vegetation adapted to climates with seasonal drought and little cold-season influence (tropical-subtropical).

Dwarf Shrubland - A class of vegetation dominated by a life form of shrubs and/or trees under 0.5 m tall. These types generally have greater than 25% cover of dwarf shrubs and less than 25% cover of trees and shrubs. Herbs and non-vascular plants may be present at any cover value. In rare cases (e.g., alpine and polar regions), dwarf shrub cover may exceed the cover of trees, shrubs, herbs and, non-vascular plants and be less than 25% of the total cover.

Dwarf Shrubs - Multi-stemmed woody plants with a life form at a height of less than 0.5 m due either to genetic or environmental constraints.

Earth Cover - The observed physical cover as seen on the ground or through remote sensing. Examples of earth cover classes might be vegetated, unvegetated, water and artificial cover (human construction). A given piece of land can only fit in one earth cover class that makes earth cover mutually exclusive at the same scale of mapping.

Ephemeral Forb Vegetation - Annual associations or synusiae that, during favorable periods, dominate areas that are usually sparsely vegetated or unvegetated for most of the year.

Epiphyte - Vascular plant that grows by germinating and rooting on other plants or other perched structures; sometimes called "air plants."

Episodic Forb Vegetation - Herbaceous-dominated associations that occupy areas periodically denuded of vegetation.

Ericoid - Plants of the Heath Family or Family Eriaceae; for example, heaths, rhododendrons, and blueberries (Erica, Rhododendron, and Vaccinium).

Established - Species that invade, occupy, and reproduce on a non-native site.

Evergreen - A plant that has green leaves all year round; or a plant that in xeric habitats has green stems or trunks and never produces leaves.

Evergreen Cover - Vegetation classes where 75% or more of the diagnostic vegetation consists of trees or shrubs having leaves all year. Canopy is never without green foliage. Examples are pine, spruce, juniper, laurel, Cefrela, Ceiba, Guaiacum, Live Oak, Magnolia, Mescal Bean, Texas Ebony, Palms, etc.

Evergreen Vegetation - Associations in which evergreen woody plants generally contribute 75% or more to total dominant plant cover; vegetation canopy is never without photosynthetic tissue.

Extremely Xeromorphic - Associations that are adapted primarily to growing in drought-persistent environments and are only secondarily adapted to other environmental stresses; plants typically have several well-developed xeromorphic characteristics.

Facultatively Deciduous - Evergreen species that shed leaves only under extreme conditions; this strategy is often associated with plants found in semiarid saline/alkaline environments; for example, Atriplex-Kochia saltbush in Australia and North America.

Foliose Lichen - Lichen life form that is leafy in appearance and loosely attached to its substrate; lichen with a lobed, flattened thallus growing loosely attached to the substrate, the lobes flattened or inflated with distinctly differentiated upper and lower surfaces; umbilicate lichens are included.

Forb - A broad-leaved herbaceous plant.

Formation - A level in the classification based on ecological groupings of vegetation units with broadly defined environmental and additional physiognomic factors in common. This level is subject to revision as the vegetation Alliances and Associations are organized under the upper levels of the hierarchy. Different variables are applied to this hierarchical level in the sparsely vegetated class.

Fresh Water - Water with a salinity of less than 0.5 parts per thousand.

Fruit/Nut Shrubs and Vines (vineyards) - Areas dominated by fruit or nut shrubs and vines planted on a regular and generally consistent row and plant spacing. Vegetation is planted for the purpose of producing a fruit or nut crop. Examples include blueberries, cranberries, blackberries, and grapes.

Fruticose Lichen - Lichen life form that is bunched, shrubby or "hairy" in appearance and loosely attached to its substrate; lichen with the thallus branched, the branches solid, or hollow and round, or flattened without distinctly differentiated upper and lower surfaces; squamulose lichens are included.

Giant - Mature forests in which the height of a typical canopy exceeds 50 meters or 165 feet.

Graminoid - Grasses and grass-like plants, including sedges and rushes.

Grassland - Vegetation dominated by perennial graminoid plants.

Growth Form - The shape or appearance of a plant; it primarily reflects the influence of growing conditions.

Hemi-sclerophyllous - A plant with stiff, firm, leathery leaves that partially retain their rigidity during wilting; for example, rhododendron and salal (Rhododendron and Gaultheria).

Herb - A vascular plant without significant woody tissue above or at the ground; an annual, biennial, or perennial plant lacking significant thickening by secondary woody growth, with perennating buds borne at or below the ground surface (hemicryophytes, geophytes, helophytes, and therophytes of Raunkier).

Herbaceous - A class of vegetation dominated by non-woody plants known as herbs (graminoids, forbs and ferns). Herbs generally form at least 25% cover. Trees, shrub and dwarf shrub generally have less than 25% cover. In rare cases, herbaceous cover exceeds the combined cover of trees, shrubs, dwarf shrubs, and non-vascular plants and is less than 25% cover. Height classes for the graminoids are short (<0.5 m), medium-tall (0.5-1 m) and tall (>1 m). Height classes for the forbs are low (<1 m) and tall (>1 m). For both graminoids and forbs, the height classes are measured when the inflorescences are fully developed.

Herbaceous Vegetation - Vegetation in which herbs (mostly graminoids, forbs, and ferns) form at least 25% cover, and woody vegetation has generally less than 25% cover; herbaceous cover may be less than 25% in cases where the cover of each of the other life forms present is less than 25% and herbaceous cover exceeds the cover of the other life forms.

Herbs - Non-woody vascular plants such as grasses, grass-like plants, and forbs.

Hydrophyte - A plant which has evolved with adaptations to live in aquatic or very wet habitats, e.g., cattail, water lily, water tupelo.

Hydromorphous Herbs - Herbaceous plants structurally adapted for life in water-dominated or aquatic habitats.

Intermittently Flooded - Substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season and is dependent upon highly localized rain storms. This modifier was developed for use in the arid West for water regimes of Playa lakes, intermittent streams, and dry washes but can be used in other parts of the U.S. where appropriate. This modifier can be applied to both wetland and non-wetland situations. Equivalent to Cowardin's Intermittently Flooded modifier.

Krummholz - Growth form assumed by tree species at the upper treeline or in the alpine zone; characterized by a creeping and multi-stemmed growth pattern due to desiccation and physical damage caused by wind and blowing ice crystals near the upper treeline; the same species grows as an erect, single-stemmed tree at lower elevation.

Landscaped Urban/Suburban/Rural - Areas consisting of partially or entirely planted vegetation which is intensively managed for aesthetics, erosion control, horticultural, and/or recreation. Examples include vegetated areas around residential dwellings, industry, golf courses, transportation right-of-ways, and nurseries.

Legend - The list of classification types that are portrayed on a map. The legend will contain a subset of the total classes in the overall classification standard.

Lichen - An organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in symbiotic association.

Life Form (growth form) - A classification of plants based upon their size, morphology, habit, life span, and woodiness.

Lignified - A plant with woody tissue developed by secondary cell wall thickening by lignin and cellulose.

Low Forb - A broad-leaved herbaceous plant usually less than 1 meter or 3 feet tall when inflorescences are fully developed.

Lowland - A large land area with vegetation reflecting limits set by regional climate and soil/site conditions; an area where elevation is not the primary gradient affecting vegetation zonation.

Matted - A creeping plant that by reiterative growth has overlapping stems and forms a low, dense ground cover.

Medium-tall Grassland - Graminoid-dominated vegetation usually between 0.5 to 1 meter or 1.5 to 3 feet tall when inflorescences are fully developed in temperate zones and to 2 meters or 6 feet in tropical zones.

Metadata - Data about data. This describes the content, quality, condition, and other characteristics of data. Its purpose is to: help organize and maintain a organization's internal investment in spatial data, provide information about an organization's data holdings to data catalogues, clearinghouses , and brokerages, and provide information to process and interpret data received through a transfer from an external source.

Microphyllous - A plant with small leaves; individual leaf surface areas are less than 500 square millimeters or one square inch.

Mixed Evergreen-deciduous - Vegetation in which evergreen and deciduous species each generally contribute 25-75% to the total canopy cover.

Mixed Evergreen Deciduous Cover - A class of vegetation types where trees (or shrubs) are the dominant life form and neither deciduous nor evergreen species represent more than 75% of cover present.

Montane - The zone in mountainous regions where the influence of altitude (vertical relief) results in local climatic regimes that are sufficiently different from those in the adjacent lowlands as to cause a complex vertical climate-vegetation-soil zonation; includes vegetation at the base of a mountain when it is different from lowland vegetation.

Natural/Semi-natural - Areas dominated by native or established vegetation that has not been cultivated or treated with any annual management or manipulation regime. In cases where it cannot be assessed whether the vegetation was planted or cultivated by humans, the vegetation is considered "Natural/Semi-Natural."

Needle-leaved - A plant with slender, elongated leaves; for example, pine and fir trees (Pinus and Abies).

Non-agricultural Disturbed Areas - Areas with little or no vegetation which have been disturbed by human activity other than for the production of agricultural crops. Examples include areas such as construction sites for urban and residential, mining operations, and landfills.

Non-vascular - Bryoids and lichens dominate with generally at least 25 % canopy cover, while trees, shrubs, dwarf shrubs, and herbs generally make up less than 25% cover. In some regions, non-vascular cover may exceed trees, shrubs, dwarf shrubs, and herbs and be less than 25% of the total cover.

Non-vascular Plant - A plant without specialized water or fluid conductive tissue (xylem and phloem); includes bryophytes, lichens, and algae.

Non-vascular Vegetation - Vegetation that is dominated by bryophytes and lichens, generally forming at least 25% cover, with other vegetation forming less than 25% cover; nonvascular cover may be less than 25% in cases where the cover of each of the other life forms present is less than 25% and nonvascular cover exceeds the cover of other life forms.

Non-vegetated - A class with less than 1 % of the surface area with vegetation cover naturally or from which vegetation is removed and replaced by man (human)-made surfaces or structures.

Open Tree Canopy - A class of vegetation types dominated by trees with crowns not touching, generally forming 25-60% cover. In rare cases, tree cover may exceed the combined cover of shrubs, dwarf shrubs, herbs and non-vascular plants and be less than 25% of the total cover.

Orchards and Groves - Areas dominated by fruit or nut trees planted on a regular and generally consistent row and plant spacing. Stands are planted for the purpose of producing a fruit or nut crop. Examples include areas used for the production of apples, peaches, oranges, pecans, walnuts, cherries, and bananas.

Order - This is a the next level in the hierarchy under Division. The Orders within the Vegetated Division are generally defined by dominant life form (tree, shrub, dwarf shrub, herbaceous, or non-vascular).

Pavement - A relatively flat surface of consolidated material, generally exposed bedrock.

Perennial - Plant species with a life-cycle that characteristically lasts more than two growing seasons and persists for several years.

Perennial Forb Close-Grown Crops - Perennial forbs which are drill-seeded or broadcast. Examples include alfalfa, clover, and lespedeza.

Perennial Forb Row Crops - Perennial forb vegetation planted in rows on a regular and generally consistent row and plant spacing. Examples include strawberries.

Perennial Grass Crops (hayland, pastureland) - Areas of dominantly perennial grasses, either native or non-native species, planted and/or intensively managed as pure or mixed-species stands. Stands often managed for the production of feed or seed, or are grazed. Examples include hayland, pastureland, and native pasture.

Perennial Herbaceous Vegetation - Associations that persist for several years and are dominated by herbaceous species.

Permanently Flooded - Water that covers the land surface at all times of the year in all years. Equivalent to Cowardin's (1979) "permanently flooded".

Permanently Flooded-tidal - Salt water that covers the land surface at all times of the year in all years. This modifier applies only to permanently flooded areas irregularly flooded by fresh tidal water. Equivalent to Cowardin's (1979) "permanently flooded/tidal".

Physiognomic Class - A level in the classification hierarchy defined by the relative percent canopy cover of the tree, shrub, dwarf shrub, herb, and nonvascular life form in the uppermost strata during the peak of the growing season.

Physiognomic Group - A level in the classification defined by a combination of climate, leaf morphology, and leaf phenology. Different variables are applied to this hierarchical level in the sparsely vegetated class.

Physiognomic Subclass - A level in the classification determined by the predominant leaf phenology of classes defined by tree, shrub, or dwarf shrub stratum (evergreen, deciduous, mixed evergreen-deciduous), and the average vegetation height for the herbaceous stratum (tall, medium, short). Different variables are applied to this hierarchical level in the sparsely vegetated class.

Physiognomy - The structure and life form of a plant community.

Plantations - Areas dominated by trees planted on a regular and generally consistent row and plant spacing. Stands are planted for the purpose of producing a crop of timber, Christmas trees, or other products. Examples include planted hardwood and softwood timber stands.

Planted/Cultivated - Areas dominated with vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. The majority of vegetation in these areas is planted and/or maintained for the production of food, feed, fiber, or seed. This subgroup is denoted by a "C" and includes:

a) Vegetation planted in built-up settings, for recreation, erosion control, or aesthetic purposes.
b) All areas used in the production of crops, such as corn, soybeans, vegetables, tobacco, cotton, wheat, and rice, grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops.
c) Orchards, vineyards, and tree plantations planted for the production of fruit, nuts, fiber (wood), or ornamental.

In cases where one can not assess whether it was planted by humans (e.g., some mature forests), the vegetation is consider "natural/semi-natural." Denoted by subgroup "N".

Plurality - The plant species that has the most numerous numbers on a site.

Polar - Geographically, the areas within the Arctic and Antarctic circles in which the sun is entirely not visible for six months and is constantly above the horizon for the next six months; climatically, polar regions are characterized by the lack of a period of warmth and by enduring cold; in polar climates the average temperature of each month is below 10* C (50* F).

Pulvinate Mosses - Mosses growing in cushion-like mats or clumps.

Rainforest - Vegetation in frost-free areas dominated by trees that are always wet from rain.

Repeatable Patterns of Assemblages - see Cover Type

Revolute - Rolled toward the lower surface of a leaf.

Rosulate - A plant with leaves arranged in rosettes (circular clusters).

Rounded-crowned - A needle-leaved evergreen tree with a basically semi-circular canopy or life form; for example, whitebark pine and alligator juniper (Pinus albicaulis and Juniperus deppeana).

Saltwater - Water with a salinity of greater than 30 parts per thousand.

Saturated - Surface water is seldom present, but substrate is saturated to surface for extended periods during the growing season. Equivalent to Cowardin's (1979) Saturated modifier.

Scale-leaved - A plant with small, overlapping leaves that usually lie flat on the stem; for example, eastern redcedar and western redcedar (Juniperus virginiana and Thuja plicata).

Sclerophyllous - A plant with usually evergreen leaves that are stiff and firm and retain their stiffness even when wilted; they are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.

Scree - A sheet of coarse rock debris covering a mountain slope without an adjacent cliff.

Scrub - Vegetation dominated by shrubs, including thickets.

Seasonal - Showing periodicity related to the seasons; applied to vegetation exhibiting pronounced seasonal periodicity marked by conspicuous physiognomic changes.

Seasonal Evergreen Vegetation - Associations in which most of the upper canopy plants retain leaves year-round and drop some leaves during unfavorable seasons.

Seasonally Flooded - Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is very variable, extending from saturated to a water table well below the ground surface. Includes Cowardin's (1979) Seasonal, Seasonal-Saturated, and Seasonal Well Drained modifiers.

Semi-arid - A climatic region having an annual precipitation, usually between 25.4 and 50.8 centimeters or 10 and 20 inches, that is higher than a truly arid climate; typically, vegetation is composed of grasses with or without woody plant layers.

Semi-deciduous Vegetation - Associations (usually tropical and subtropical) in which most of the upper canopy trees are drought-deciduous and many of the understory trees and shrubs are evergreen. The evergreen and deciduous woody plants are not always separated by layers.

Semi-evergreen Vegetation - Associations in which evergreen and deciduous species each generally contribute 25-75% of total tree cover; specifically, this term refers to tropical and subtropical vegetation in which most of the upper canopy trees are evergreen mixed with drought-deciduous trees.

Semi-permanently Flooded - Surface waters persists throughout growing season in most years except during periods of drought. Land surface is normally saturated when water level drops below soil surface. Includes Cowardin's (1979) Intermittently Exposed and Semi-permanently Flooded modifiers.

Short Grassland - Graminoid-dominated vegetation usually less than 0.5 meters or 1.5 feet tall when inflorescences are fully developed.

Shrubland - A class of vegetation defined by areas dominated by shrubs generally greater than 0.5 m tall with individuals or clumps not touching to interlocking. Shrub canopy cover is generally greater than 25% while tree cover is generally less than 25%. In rare cases, shrub cover exceeds the tree, dwarf shrub, herb, non-vascular plant cover and is less than 25% cover.

Shrubs - Woody plants greater than 0.5 m in height that generally exhibit several erect, spreading, or prostrate stems; and have a bushy appearance. In instances where life form cannot be determined, woody plants greater than 0.5 m in height, but less than 5 m in height will be considered shrubs.

Sod Grass - A life form of graminoids that tends to develop a solid mat of grass, sedge, etc. over the ground by vegetative increase of rhizomes or stolons; resulting vegetation generally has few spaces between plants.

Sparsely Vegetated - A class of vegetation types that are defined as having a surface area with 1-10% vegetation cover over the landscape at the peak of the growing season.

Stomata - Pores or openings for gas exchange that are generally concentrated on leaf surfaces.

Subalpine - Upper mountain vegetation immediately below the cold limits of tree and tall shrub growth.

Subdesert - An area of xerophytic shrubby vegetation with a poorly-developed herbaceous layer.

Subgroup - A level of the hierarchy that splits Natural/Semi-Natural vegetation types from the Planted/Cultivated vegetation types.

Submontane - An area where the influence of altitude (vertical relief) does not result in local climate regimes that are sufficiently different from the adjacent lowlands as to cause a complex vegetation-climate-soil zonation; generally includes the foothills of a mountain range; the lowland vegetation at the base of a mountain that displays vegetation zonation.

Subpolar - Geographically, the region immediately equator-ward of the Arctic and Antarctic circles; climatically, winters are long and extremely cold, and summers are very short; only one month per year has a monthly average warmer than 10* C (50* F); as a rule, the ground is completely covered by snow for at least half a year; the region between the tundra and cold temperate forests or steppes.

Subtropical - Pertains to areas within tropical regions with variable (seasonal) temperature and moisture regimes; climatically, it has seasonal variation marked by dry/wet seasons rather than cold/hot seasons; parts of this region are subject to sub-0* C (32* F) temperatures but rarely have freezing periods of 24 hours or longer; in the United States this term includes southern Florida and the southern tip of Texas.

Succulent - A plant with fleshy stems or leaves with specialized tissue for the conservation of water; a xeromorphic strategy for tolerating long periods of drought.

Suffruticose - A somewhat shrubby plant in which the upper vegetative and flowering shoots die back to leave only the lower parts to survive unfavorable seasons.

Synusia - An association of plant species with a similar life form and similar ecological requirements occurring together in the same habitat; sometimes called a "union"; most habitats are occupied by several synusiae, which may grow above each other in layers, beside each other, or in mixture; for example, an open tree synusia or layer over a grass-dominated synusia or layer.

Tall Forb - Broad-leaved herbaceous plants usually greater than 1 meter or 3 feet tall when inflorescences are fully developed.

Tall Grassland - Graminoid-dominated vegetation usually over 1 meter or 3 feet tall when inflorescences are fully developed in temperate zones and greater than 2 meters or 6 feet in tropical zones.

Talus - A sloping accumulation of coarse rock fragments at the base of a cliff.

Temperate - A geographically, the region between the polar and tropical regions; climatically, the region is moderate with distinct seasons of alternating long, warm summers and short, cold winters.

Temporarily Flooded - Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Often characterizes flood-plain wetlands. Equivalent to Cowardin's (1979) Temporary modifier.

Tidally Flooded - Areas flooded by the alternate rise and fall of the surface of oceans, seas, and the bays, rivers, etc. connected to them, caused by the attraction of the moon and sun [or by the back-up of water caused by unfavorable winds].

Trees - Woody plants that generally have a single main stem and have more or less definite crowns. In instances where life form cannot be determined, woody plants equal to or greater than 5 m in height will be considered trees.

Treeline - A zone where the normal growth of trees is limited; cold temperatures often combined with drought form the upper or arctic treeline, and drought combined with hot temperatures form lower or arid treeline.

Tropical - Geographically, the area between the Tropic of Cancer (23 27' N) and the Tropic of Capricorn (23 27' S), which includes tropical montane and alpine zones; climatically, the tropics are described as either the equatorial limits of freeze or, in temperate marine locations without freezing, the 65* F isotherm for the coldest month of the year; generally, tropical regions are characterized by high mean temperatures, small annual variation in temperature, and abundant rainfall throughout the year, although mountainous areas within the tropics are more variable.

Tuft-tree - Woody plant with large leaf-fronds or rosulate branches at the tips of major trunk(s); for example, palms and tree ferns.

Tundra - The treeless region north of the Arctic Circle (arctic tundra) or above the treeline of high mountains (alpine tundra) and on some sub-Antarctic islands; characterized by very low winter temperatures, short cool summers, permafrost below a surface layer subject to summer melt, short growing season, and low precipitation.

Tussock - Graminoid life form consisting of bunch-like tufts, sometimes more than 1 meter or 3 feet tall, in which the hard, old, withered leaves are intermingled with the fresh, young, green leaves.

Vascular Plant - Plant with water and fluid conductive tissue (xylem and phloem); includes seed plants, ferns, and fern allies.

Vegetated - Areas having equal to or greater than 1% or more of the land or water surface with live vegetation cover at the peak of the growing season.

Vegetation - The collective plant cover over an area.

Vegetation Cover - Vegetation that covers or is visible at or above the land or water surface. It is a sub-category of Earth cover. The percentage of the ground covered by a vertical projection of the outermost perimeter of the natural spread of the foliage of plants.

Vegetation Data - The attributes of the vegetation that are used to classify and characterize the vegetation type and to map a vegetation stand. These data come from the interpretation of remotely sensed imagery, field work, and other thematic data sources.

Vegetation Stands - Contiguous areas that are homogenous with respect to the current condition of vegetation; that is, these are plant communities possessing sufficient uniformity in regard to composition and structure to be clearly different from adjacent areas.

Winter-rain - A climatic regime characterized by precipitation that occurs mostly as rain during cool winters that alternate with dry, hot summers; often associated with sclerophyllous vegetation.

Woody Plant - Plant species life form with woody tissue and buds on that woody tissue near or at the ground surface or above; plants with limited to extensive thickening by secondary woody growth and with perennating buds; includes phanerophytes and chamaephytes of Raunkier.

Woody - Containing lignified plant tissue.

Xeromorphic (Scleromorphic) - Having structural characteristics common among plants adapted to drought, i.e., small thick leaves with sunken stomata or revolute margins, surfaces that are heavily pubescent, waxy or highly reflective and small vein islets.