

## US National Vegetation Classification: FAQ

### 1) What is the US National Vegetation Classification Standard (NVCS)?

The USNVCS is a Federal Geographic Data Committee (FGDC) “classification methodology standard” that provides a hierarchy of vegetation levels and describes how to classify vegetation into those hierarchical levels. These categories help users of the standard classify and aggregate local and regional vegetation inventory data, assess the distribution of vegetation types at multiple levels across land management boundaries, and generate national statistics on vegetation resources.

The FGDC originally adopted the USNVCS in 1997 and formally modified it in 2008 ([http://usnvc.org/wp-content/uploads/2011/02/NVCS\\_V2\\_FINAL\\_2008-02.pdf](http://usnvc.org/wp-content/uploads/2011/02/NVCS_V2_FINAL_2008-02.pdf); NVCS, FGDC 2008). The 2008 Standard is innovative because of its dynamic nature; the process for identifying and classifying vegetation is standardized, but the content of the classification is allowed to evolve over time as new data and analyses are completed. The USNVCS includes standards for data collection, data analysis, data presentation, and quality control and assurance as described in the FGDC Standards.

### 2) What is the US National Vegetation Classification (USNVC)?

The USNVC is a classification of “existing” vegetation based on the physiognomy and taxonomy of all plant communities, including those anthropogenically maintained, that are observable in the United States (FGDC 2008; <http://usnvc.org/data-standard/>). The classification follows the USNVCS and is based on plant growth forms (as these respond to climate, elevation, substrates, etc.) and plant species composition (including overall composition, dominants, diagnostics and constants), as these reflect biogeographic and ecologic relations (Faber-Langendoen et al. 2009, 2013).

The classification includes hierarchies for two distinct categories of vegetation: Natural/Semi-Natural (driven primarily by natural ecological processes) and Cultural (driven primarily by anthropogenic processes). The hierarchy for classifying natural/semi-natural vegetation incorporates criteria for physiognomy (top 3 levels), general floristic composition and biogeography (mid 3 levels), and detailed floristic composition (lowest 2 levels). Ecological considerations integrate all criteria. A description of each classification concept is available for those levels that have been reviewed (<http://usnvc.org/explore-classification/>). The hierarchy for classifying cultural vegetation incorporates floristic and physiognomic criteria as the primary characteristics used to define all units of the classification, but those are assessed in light of human activities that govern these properties.

Hierarchical classification for natural /semi-natural vegetation, with examples.

Natural Vegetation	Example
<b>Upper Levels</b>	
1 – Formation Class	<b>Scientific Name:</b> Mesomorphic Shrub & Herb Vegetation <b>Colloquial Name:</b> Shrubland & Grassland
2 – Formation Subclass	<b>Scientific Name:</b> Temperate & Boreal Shrub & Herb Vegetation <b>Colloquial Name:</b> Temperate & Boreal Grassland & Shrubland
3 - Formation	<b>Scientific Name:</b> Temperate Shrub & Herb Vegetation <b>Colloquial Name:</b> Temperate Grassland & Shrubland

Mid Levels	
4 – Division	<b>Scientific Name:</b> <i>Andropogon – Stipa – Bouteloua</i> Grassland & Shrubland Division <b>Colloquial Name:</b> Great Plains Grassland & Shrubland
5 – Macrogroup	<b>Scientific Name:</b> <i>Andropogon gerardii – Schizachyrium scoparium – Sorghastrum nutans</i> Grassland & Shrubland Macrogroup <b>Colloquial Name:</b> Great Plains Tallgrass Prairie & Shrubland
6 – Group	<b>Scientific Name:</b> <i>Andropogon gerardii – Sporobolus heterolepis</i> Grassland Group <b>Colloquial Name:</b> Northern & Central Great Plains Tallgrass Prairie
Lower Levels	
7 – Alliance	<b>Scientific Name:</b> <i>Andropogon gerardii – (Calamagrostis canadensis – Panicum virgatum)</i> Grassland Alliance <b>Colloquial Name:</b> Northern & Central Wet-mesic Tallgrass Prairie
8 – Association	<b>Scientific Name:</b> <i>Andropogon gerardii – Panicum virgatum – Helianthus grosseserratus</i> Grassland <b>Colloquial Name:</b> Central Wet-mesic Tallgrass Prairie

Hierarchical classification for cultural vegetation, with examples.

Cultural Vegetation	Example	Example
Upper Levels		
1 – Cultural Class	Agricultural & Developed Vegetation (Anthromorphic Vegetation)	Agricultural & Developed Vegetation (Anthromorphic Vegetation)
2 – Cultural Subclass	Herbaceous Agricultural Vegetation	Woody Agricultural Vegetation
3 – Cultural Formation	Row & Close Grain Crop	Woody Horticultural Crop
4 – Cultural Subformation	Graminoid Row Crop	Orchard
Mid Levels		
5 – Cultural Group [optional]	<i>Tropical &amp; Temperate Corn Crop</i>	<i>Tropical &amp; Temperate Tree Orchard</i>
6 – Cultural Subgroup	Temperate Corn Crop	Fruit Orchard
Lower Levels		
7 – Cultural Type	Maize Corn Crop	Apple
8 – Cultural Subtype [optional]	<i>Sweet Corn Crop</i>	

### 3) Who developed the USNVCS?

The USNVCS was developed through the FGDC Vegetation Subcommittee, which is a partnership of NatureServe (previously, The Nature Conservancy), the Ecological Society of America (ESA) Panel on Vegetation Classification (Franklin et al. 2012) and various federal agencies, especially the US Forest Service, US Geological Survey, National Park Service, Bureau of Land Management, and Natural Resources Conservation Service (NRCS).

Descriptions for the top three levels of the classification (L1 – L3) were written by a special international committee — the Hierarchy Revisions Working Group (HRWG) — and peer reviewed by the ESA Panel and international colleagues. Descriptions for the Division, Macrogroup, Group and Alliance levels of the classification (L4-L7) are being developed by NatureServe staff working closely

USNVC.ORG

with federal, academic and state Natural Heritage staff, and are being peer reviewed by Associate Editors of the Peer Review Board of the ESA Panel on Vegetation Classification. Descriptions for the Association (L8) level of the classification have been developed over two decades by a variety of partners, and are being screened for quality using a tool developed by NatureServe and the ESA Panel on Vegetation Classification.

#### **4) Is use of the USNVC mandatory?**

Federally-funded vegetation classification projects must collect, record, and classify data and information in a manner that allows others to “crosswalk” the project vegetation classes to some level of the USNVC. In one sense, this means that descriptions from a given project classification should be relatable to descriptions within the USNVC. At the most fundamental level, field data collected to support a federal agency project should meet the minimum standards for vegetation data collection set forth in the NVCS ([http://usnvc.org/wp-content/uploads/2011/02/NVCS\\_V2\\_FINAL\\_2008-02.pdf](http://usnvc.org/wp-content/uploads/2011/02/NVCS_V2_FINAL_2008-02.pdf); FGDC 2008 for more information).

The National Vegetation Classification Standard establishes national procedures for development and use of a consistent national vegetation classification for the United States and its Trust Territories. Such use is intended to produce uniform statistics about vegetation resources across the nation, facilitate and information sharing by and between federal agencies and other public and private groups, and facilitate cooperation on vegetation management issues that transcend jurisdictional boundaries.

The overall purpose of this standard encompasses four broad objectives:

1. development of a standardized vegetation classification for the United States and its use for information sharing.
2. establishment of standards for vegetation data collection and analysis used in support of vegetation classification.
3. maintaining scientific credibility of the national classification through peer review.
4. facilitating inter-agency collaboration and inter-agency product consistency.

This Standard shall be followed by all Federal agencies for vegetation classification data collected directly or indirectly (through grants, partnerships, or contracts) using federal funds. This Standard shall be used by Federal agencies to facilitate reporting of national statistics across ownerships. This standard requires all federal vegetation classification efforts to meet core data requirements that are the same across all federal agencies. This Standard leaves each Federal agency free to develop vegetation classification systems that meet its own information and business needs and to apply the Standard at a level of the hierarchy appropriate to its needs. This Standard shall not preclude alternative classification approaches and systems that address particular needs of Federal agencies and should not hamper local Federal efforts from doing whatever they need to meet their specific purposes, such as inventory, monitoring, and mapping. The Standard does require that Federal efforts are conducted in ways that provide the minimum data needed to integrate plot data and crosswalk vegetation types and map units to the NVC.

USNVC.ORG

**5) What can the USNVC do, and what are its limits? (See also Question #13)**

The USNVC provides a standard for classifying existing vegetation and a nation-wide source to interpret plant community characteristics and biodiversity. The standard does not predict development of future vegetation.

Translations or synonymies between the USNVC and several other classification systems have already been done. The classification allows data about vegetation sampled in the course of field inventory or research to be matched to one or more vegetation concepts in the USNVC, similar to the function of soil, landscape, aquatic, and other ecological classifications.

Use of a rigorous, established and testable set of vegetation classes and descriptions provides those users the ability to save time and expense of creating their own classification scheme. The USNVC allows for users to identify a community concept from their data, compare their concepts to the national classification, and crosswalk to other classifications (see 13 below).

The classification does not predict some future potential type)of vegetation; that is, concepts of “potential” vegetation that may be used to indicate site productivity, often for forestry and rangeland applications. Nor does it aim to predict potential novel community concepts that could develop on a particular site (see question 13, below).

The classification must be continually updated as new data are collected and concepts developed. Many of the existing descriptions are already based on empirical evidence and previously published concepts, and so are not expected to change substantially. These existing community concepts were peer reviewed and assigned a quality rating of high, medium, or low quality or, for those with very little empirical evidence, a “provisional” rating). These quality levels guide users regarding the strengths and limitations of the Classification.

**6) Is the system comprehensive enough to use everywhere?**

Absolutely! The USNVC contains descriptions of most known vegetation type concepts across the United States, and, particularly at mid and upper levels of the classification, the concepts are fairly well established for all vegetation. These concepts are based on the observations and analyses of a century of vegetation science in North America.

The upper levels are now fully described not only across the US but around the globe (Faber-Langendoen et al. 2012). Because of the dynamic nature of the standard, there is ongoing value in strengthening these concepts through well documented analyses based on plot data that are stored in publicly accessible vegetation databases. These data are particularly critical for improving the Alliance and Association concepts. The ultimate goal is to have all concepts supported by field plot data.

**7) Is the USNVC appropriate for mapping?**

The USNVC is useful for defining vegetation map classes because much important information about vegetation is geographical (e.g. where does a vegetation type occur?) and spatial (e.g. how extensive is a vegetation type?; what types occur in what size patches?; what types co-occur with what other types?). Also, the quantitative and testable definitions developed for the USNVC can be directly

USNVC.ORG

related to assessing accuracy of map units and to developing thematically accurate and repeatable mapping products. USNVC floristic, physiognomic, ecological and biogeographical classification criteria are being used to inform development of map classification criteria. This close relationship between USNVC criteria and map unit criteria provides valuable opportunities for different mapping organizations to develop their individual maps in ways that make them compatible across boundaries on the land.

A common issue in vegetation mapping is reconciling mapping technique, available remote sensing and field information, and desired level of classification detail. For example, it is often quite challenging to directly map local-scale classification concepts, like USNVC Associations, across large landscapes or regions, so map-makers often turn to USNVC mid and upper levels for depicting large landscapes and regions. Whenever today's high resolution imagery enables better matching between what can be interpreted and what exists on the ground, map-makers can achieve surprisingly detailed mapping over large areas as long as sufficient field data are available to support the process. Mapping projects that cover large areas and a variety of vegetation types also benefit from using multiple levels of the USNVC hierarchy for their mapping units, resolving some units to finer scales than others depending on the distinctiveness of their signatures on the imagery.

**8) What is the plan for “filling in the gaps” for those vegetation concepts with inadequate supporting data?**

The USNVC will become fully functional when every concept has a substantial representation of plots and documented field observations from throughout its known range. Achieving this functionality requires ongoing commitment by both the scientific and management communities dedicated to the goals of vegetation classification. The high, medium, and low quality assessment scale used to rate each concept provide some direction for adopting priorities for improving the USNVC: see “**How can I contribute to the USNVC?**”

**9) How can I contribute to the USNVC?**

There are four specific ways to contribute to the USNVC: Collecting plot data based on the methodology established in the Standard, submitting plot data to VegBank, proposing changes to concepts (or suggesting a new concept altogether), and volunteering as a reviewer or Associate Editor.

*A. Collect plot data based on the standard.* The best classifications come from analyzing plot data, and thus the more comprehensive the plot data, the better. Often classifications are limited by too few plots within too small of a geographic area and by plot data collected and analyzed in a variety of nonconforming ways. Collecting plot data based on the NVC Standard (as detailed in FGDC 2008) and analyzing such data with standard methods (Jennings et al. 2009; Peet & Roberts 2012) will provide the basis for developing a fully realized, plot-based classification of the US vegetation.

*B. Submit plot data to VegBank.* VegBank ([www.vegbank.org](http://www.vegbank.org)) is the open-access vegetation plot database served by the ESA Panel on Vegetation Classification (see Peet et al.(2012) for information). It provides reliable storage and sharing of data, a comprehensive search function, a user-friendly interface that enables meta-analysis, and integration with both vegetation type and plant taxon databases. Submitting collected plot data to the VegBank database will allow database

USNVC.ORG

users to conduct analyses of greater community variability and spatial breadth than can be conducted by a single project.

. To broaden database opportunities, the NVC partners are seeking additional institution, organization, or program databases that can house NVC data and can share data with VegBank.

*C. Propose changes to Concepts or suggest a new Concept.* The USNVC is a dynamic classification - our knowledge is incomplete and we expect to discover new vegetation types over time. Proposals to change concepts at any level are always welcome, are prepared by following formal submission procedures, and are submitted through a professional peer review process. Proposals can be based on new plot data and/or on analysis of current literature. Proposals may either modify existing concepts or propose entirely new concepts. If the proposal is accepted, the changes will be published in an online proceedings with historical documentation of the changed concept. As with species taxonomy, synonymies of previous concept names will be maintained.

*D. Volunteer as a reviewer or Associate Editor.* The NVC Partners seek volunteers to review classification descriptions among the hierarchy levels that are still being developed. We are looking for people with expertise in plant communities and community classification, and knowledge of specific vegetation regions. Associate Editors of the ESA Peer Review Board welcome volunteers to assist in such a review. Volunteers who wish to be more directly engaged in the peer review process can become an Associate Editor and help to oversee the peer review process itself. [Contact the ESA Vegetation Classification Panel for more information.](#)

Or, choose another way to get involved (<http://usnvc.org/get-involved/>).

## **10) How can I apply the USNVC when it's not fully developed?**

Much depends upon the objectives of your work. Currently, of the eight levels in the Natural/Semi-natural vegetation hierarchy, five of them (Formation Class, Formation Subclass, Formation, Group, and Association) have been reviewed, evaluated and a level of confidence attached. Users can directly apply these concepts but should be aware of the assigned confidence (quality) levels and understand that both concepts and quality levels may change in the future. Descriptions for the Alliance, Macrogroup and Division levels are the major gaps. Many semi-natural and cultural types have yet to be described as well. By 2014, the type concepts at all levels of the hierarchy are scheduled to be available. Alliance descriptions are currently under review and will be submitted to the USNVC by Fall 2014; Macrogroup and Division descriptions will follow later that year. Users who would like to apply these concept levels in their own work can request pre-release access to these developing descriptions if it will help their research.

The finer Alliance and Association levels of the hierarchy are more locally specific as to floristic composition. There may be spatial gaps between described types, particularly in under-sampled parts of their range. In these cases, where a user has discovered a locally observed vegetation assemblage that does not clearly classify into a described concept, either a new concept may need to be proposed or an existing concept or concepts may need to be expanded to accommodate the local vegetation assemblage. However, once in the USNVC, users should be aware that all concepts will be tracked as they change over time, with changes documented. We envision this situation as being similar to that associated with species taxonomy: it is always subject to change, since not all

USNVC.ORG

species are currently described and our understanding of their taxonomic relationships advances over time.

### **11) How can the USNVC adapt to changing environments and community composition through time?**

The USNVC is set up to be a dynamic classification system that is expected to change over time. Users who discover new vegetation assemblages can propose changes to the NVC at any point, and it is through application of the NVCS proposal submission and peer review process that the USNVC will adapt to changing environments and community composition in the future.

It is important to distinguish changes in the classification based upon advancing knowledge of current conditions vs. long-term change in vegetation linked to a changing environment, such as a changing climate. Nearly all current activity is based on establishing the “baseline” of existing natural/semi-natural and cultural vegetation one might expect to encounter in the field today. A process is in place to review any proposed changes to the USNVC; the USNVC can adapt. Although concept changes may be proposed for any level at any time, proposed changes to Levels 1-5 will only be examined at minimum every five years, proposed changes to levels 6-8 will be assessed more continually, and the USNVC will be updated annually. The review process that facilitates this adaptability includes an Editor-in-Chief, several Regional Associate Editors, a number of Associate Editors, and many expert peer reviewers. The process is similar to that used for journal submissions. Ultimately, accepted proposals will become part of the USNVC Proceedings which will be available on line and will be permanently archived. Once published in the USNVC Proceedings, the new concept is incorporated into the USNVC.

Establishment of the baseline concepts of the US NVC will produce the foundation for documenting and classifying observed changes in vegetation for decades into the future, using the review process described here.

### **12) How does the USNVC deal with cultural and semi-natural vegetation?**

The USNVC classifies natural and cultural vegetation separately at the outset, and they have completely different hierarchical classifications. See Question #2 for specific examples of this.

Natural and semi-natural vegetation are treated together at the higher levels of the NVC and are split apart at the Macrogroup level based on the overwhelming dominance of ruderal and exotic species in the semi-natural vegetation. Natural vegetation is defined as vegetation where ecological processes primarily determine species and site characteristics; that is, vegetation comprised of a largely spontaneously growing set of plant species that are shaped by both site and biotic processes (Küchler 1969, Westhoff and van der Maarel 1973).

Semi-natural vegetation is defined as vegetation in which past or present human activities significantly influence composition or structure, but do not eliminate or dominate spontaneous ecological processes (Westhoff and Van der Maarel 1973). Semi-natural vegetation typically results from prior intensive human land use followed by appearance of vegetation that is dominated by spontaneously growing plants that require no human input for their maintenance and also have no apparent natural analog; e.g., “old field” vegetation assemblages that do not occur without prior, intensive human activity.

USNVC.ORG

Cultural vegetation is defined as vegetation with a distinctive structure, composition, and development determined by regular human activity (Küchler 1969). The distinctive physiognomy, floristics, and dependence on recurring human activity for its persistence set cultural vegetation apart from natural and semi-natural vegetation.

**13) How does the USNVC treat “existing” vs. “potential” vegetation? (see also Question #5)**

The USNVC classifies existing vegetation, which is vegetation found at a given location at the time of observation (Jennings et al. 2006). “Existing” vegetation types are based on the physiognomy and taxonomic composition of all plant communities, including those maintained by people, that one might observe in the field. Potential vegetation may be defined in a variety of ways, but is a projection of some state of mature vegetation based on assumptions about the relation of that vegetation to site or other ecological characteristics. Where samples of existing vegetation include mature or late seral stands, these may be seen as current expressions of potential vegetation.

The USNVC does not aim to predict future, or “potential”, vegetation (vegetation predicted to dominate a site in the future). While such predictions have their place in management (e.g., assessing the role of disturbance, site productivity, restoration), they are not the primary goal of the USNVC, which is to describe and classify the full range of vegetation currently expressed on the landscape. By contrast, classifications of potential vegetation do not include the full range of early- and mid-successional species compositions that one can observe in the field.

**14) How does the USNVC relate (crosswalk) to other systems, including international vegetation classifications and other systems used by US government agencies?**

Because the USNVC was developed with colleagues north and south of US borders and in conjunction with NatureServe’s work on an international classification, there are strong similarities among the US, Canadian, and other international classifications. See current descriptions of those concepts (<http://www.natureserve.org/explorer/classeco.htm>).

The widely used classification of Terrestrial Ecological Systems (Comer et al. 2003; <http://www.natureserve.org/library/usEcologicalsystems.pdf>; and at <http://www.natureserve.org/explorer/>) is used in mapping applications for natural uplands and wetlands (see e.g., <http://www.natureserve.org/getData/USecologyData.jsp>). The Terrestrial Ecological Systems concepts (~ 800 in the USA) were defined using a listing of NVC associations that describe each type. Current national map products may be displayed at Macrogroup and broader hierarchical levels of the USNVC (see gap land cover viewer [http://gis1.usgs.gov/csas/gap/viewer/land\\_cover/Map.aspx](http://gis1.usgs.gov/csas/gap/viewer/land_cover/Map.aspx)). The Terrestrial Ecological Systems concepts also form the basis for conceptual “state-and-transition” models of successional dynamics and for predictive maps of the “biophysical setting” used by the national Landscape Fire and Resource Management Planning Tools (LANDFIRE) effort (<http://www.landfire.gov/>).

Land classifications describe landform and soil combinations that produce recurring successional patterns and predictable site productivities. Ecological Site Descriptions (ESDs) developed by NRCS (<http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>) are examples. USNVC concepts may



USNVC.ORG

be used to describe individual “states” within “state-and-transition” models that describe successional dynamics of each ESD.

In addition most states have department and programs working with state specific vegetation classification systems (e.g. Schafale 2012, Florida Natural Areas Inventory 2010, Virginia Natural Heritage Program 2013). Those classifications are actively used to guide management and conservation at the state level. In some cases the crosswalk between the state and USNVC classification exists. Ultimately the goal is to have a complete crosswalk to all state classifications.

**15) How does the USNVC relate to coastal marine classification and other standards, and how do wetland areas fit into the system?**

All wetlands that include vegetation (either rooted or floating) are included in the USNVC. Recent work by the FGDC Wetlands Subcommittee has specifically addressed appropriate linking of existing NVC types to vegetated types in the Cowardin Classification used in the National Wetland Inventory (Cowardin et al. 1979). Coordinated efforts for classifying marine and wetland systems to determine common units and crosswalks have resulted in the recently approved FGDC Marine and Coastal Ecological Classification Standard (FGDC 2012).

**Commonly Used Acronyms**

ESA:	The Ecological Society of America
ESD:	Ecological Site Descriptions
FGDC:	Federal Geographic Data Committee
HRWG:	Hierarchy Revisions Working Group
LANDFIRE:	Landscape Fire and Resource Management Planning Tools
NVCS:	National Vegetation Classification Standard
USNVC/NVC:	The United States National Vegetation Classification System

**Literature Cited:**

Comer, P., Faber-Langendoen D., Evans R., Gawler S., Josse C., Kittel G., Menard S., Pyne M., Reid M., Schulz K., Snow K., Teague J. 2003. *Ecological systems of the United States: a working classification of U.S. terrestrial systems*. NatureServe, Arlington, Virginia, USA.

Cowardin, L. W., V. Carter, F.C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. Biological Service Program, U.S. Fish and Wildlife Service, FWS/OBS 79/31. Office of Biological Services, Fish and Wildlife Service, U.S. Department of Interior, Washington, D.C.

Faber-Langendoen, D., D.L Tart, and R.H.Crawford. 2009. Contours of the revised U.S. National Vegetation Classification standard. *Bulletin of the Ecological Society of America* 90:87-93.

Faber-Langendoen, D., T. Keeler-Wolf, D. Meidinger, C. Josse, A. Weakley, D. Tart, G. Navarro, B. Hoagland, S. Ponomarenko, J.-P. Saucier, G. Fults, E. Helmer. 2012. *Classification and description of world formation types*. Hierarchy Revisions Working Group, Federal Geographic Data Committee, FGDC Secretariat, U.S. Geological Survey, Reston, VA, and NatureServe, Arlington, VA.

USNVC.ORG

- Faber-Langendoen, D., T. Keeler-Wolf, D. Meidinger, D. Tart, C. Josse, G. Navarro, B. Hoagland, S. Ponomarenko, J.-P. Saucier, A. Weakley, P. Comer. 2013 (in review). *Guidelines for a Vegetation - Ecologic Approach to Vegetation Description and Classification*. (submitted).
- FGDC [Federal Geographic Data Committee] – Marine and Coastal Spatial Data Subcommittee. 2012. Coastal and Marine Ecological Classification Standard. FGDC Document Number FGDC-STD-018-2012.
- FGDC [Federal Geographic Data Committee] – Vegetation Subcommittee. 2008. National Vegetation Classification Standard (Version 2.0). FGDC Document Number FGDC-STD-005-2008. Vegetation Subcommittee, Federal Geographic Data Committee, Reston, VA. 126 pp.
- Florida Natural Areas Inventory (FNAI). 2010. Guide to the natural communities of Florida: 2010 edition. Florida Natural Areas Inventory, Tallahassee, FL
- Franklin S.B., D. Faber-Langendoen, M. Jennings, T. Keeler-Wolf, O. Loucks, R. Peet, D. Roberts & A. McKerron. 2012. Building the United States National Vegetation Classification. *Annali di Botanica* 2: 1-9.
- Jennings M.D., Faber-Langendoen D., Loucks O.L., Peet R.K., Roberts D. 2009. Characterizing Associations and Alliances of the U.S. National Vegetation Classification. *Ecological Monographs* 79, 173-199.
- Küchler, AW. 1969. Potential Natural Vegetation. 1:7,5000,000 color map, sheet number 90. US Department of Interior, Washington, D.C.
- Peet, RK, Roberts, DW. 2012. Chapter 2 in: J. Franklin & E. van der Maarel (eds), *Vegetation Ecology*, Second Edition. Oxford University Press, New York.
- Peet, R.K., M.T. Lee, M.D. Jennings, and D. Faber-Langendoen. 2012. VegBank: a permanent, open-access archive for vegetation plot data. *Biodiversity & Ecology* 4:233-241.
- Schafale, M. P. 2012. Guide to the Natural Communities of North Carolina. Fourth Approximation. North Carolina Natural Heritage Program. N.C. Dept. of Environment and Natural Resources.
- Virginia Natural Heritage Program. 2013. Classification of Ecological Community Groups. Second Approximation (Version 2.6; Information current as of July, 2013). Virginia Department of Conservation and Recreation.
- Westhoff V., van der Maarel E., 1973. The Braun-Blanquet approach. In: Whittaker R.H. (Ed.) *Classification of Plant Communities*, 617–726. Dr. W. Junk Publishers, The Hague, Netherlands.
- Federal Geographic Data Committee – Marine and Coastal Spatial Data Subcommittee. 2012. Coastal and Marine Ecological Classification Standard. FGDC