



How a national vegetation classification can help ecological research and management

Peer-reviewed letter

The elegance of classification lies in its ability to compile and systematize various terminological conventions and masses of information that are unattainable during typical research projects. Imagine a discipline without standards for collection, analysis, and interpretation; unfortunately, that describes much of 20th-century vegetation ecology. With differing methods, how do we assess community dynamics over decades, much less centuries? How do we compare plant communities from different areas? The need for a widely applied vegetation classification has long been clear. Now imagine a multi-decade effort to assimilate hundreds of disparate vegetation classifications into one common classification for the US. In this

letter, we introduce the US National Vegetation Classification (USNVC; www.usnvc.org) as a powerful tool for research and conservation, analogous to the argument made by Schimel and Chadwick (2013) for soils. The USNVC provides a national framework to classify and describe vegetation; here we describe the USNVC and offer brief examples of its efficacy.

Prominent uses of classification include establishing baseline knowledge (eg to assess diversity, monitor change, or develop management protocols), describing categories that integrate multiple sources of data (eg vegetation, environment, and disturbance), and conducting larger-scale analyses (temporal and spatial). For these reasons, the US Federal Geographic Data Committee (FGDC; www.fgdc.gov) developed standards for classifying the nation's resources. Federal agencies and non-federal partners (NatureServe and the Ecological Society of America's

[ESA's] Vegetation Classification Panel) of the FGDC Vegetation Subcommittee formalized standards for vegetation classification in 2008 (FGDC 2008; Peet 2008; Faber-Langendoen *et al.* 2009; Jennings *et al.* 2009). They developed an eight-level hierarchy (WebTable 1), a common terminology that is international in scope (Faber-Langendoen *et al.* 2014), and a dynamic content standard. The Classification is dynamic in that it can be updated through a proposal and review process with changes archived at www.usnvc.org/proceedings (Franklin *et al.* 2012). This review process functions in two ways: (1) it establishes a minimum effort, including quality and spatial extent of data, required for proposing new vegetation types, and (2) it precludes an explosion of site-specific community types as all changes are reviewed in light of already established types (Matthews *et al.* 2011).

The USNVC is a classification of

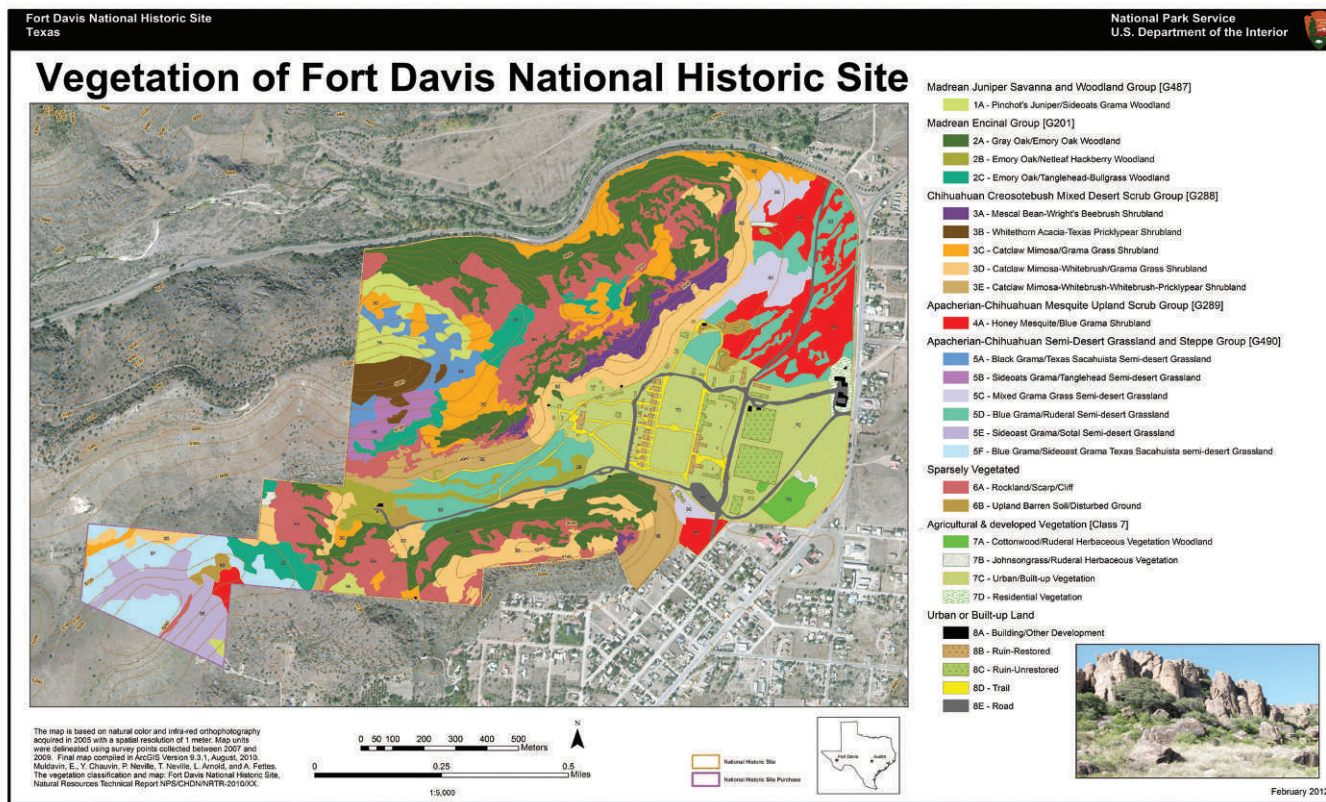


Figure 1. Vegetation and land-cover map based on USNVC concepts for the Fort Davis National Historic Site, Texas (Muldavin E, Chauwin Y, Neville P, et al. 2012). A vegetation classification and map: Fort Davis National Historic Site. Natural Resource Technical Report NPS/CHDN/NRTR–2012/639. Fort Collins, CO: National Park Service); concepts are at the Group and nested Association levels for natural and semi-natural vegetation and at the Class level for cultural vegetation.

existing vegetation (in contrast to potential vegetation). The Classification separates natural and semi-natural vegetation (growing spontaneously and shaped generally by ecological processes) from cultural vegetation (shaped by anthropogenic processes, eg corn fields or golf courses). By including all vegetation types in a consistent framework, we can address issues such as wildfire regimes, pest infestations, exotic species invasions, lateral ecosystem exchanges, and vegetation shifts. In addition, such a holistic classification is necessary for the “all lands approach” used by several government agencies to ensure land management planning takes place in the context of the larger landscape.

The USNVC provides substantial information to aid ecological research and resource management: for instance, local site descriptions for field studies or descriptions of typical environments of species (as with soils; Schimel and Chadwick 2013). Current agency assessment and planning projects (WebTable 2) require integration of ecology, biogeography, structure, growth forms, and floristics to interpret biotic and abiotic conditions at multiple geographical and ecological scales (see “definitions” in WebTable 1). The Classification has improved the sharing of vegetation information among agencies for intra- and interagency management. The presence of repeatable and defensible standardized units of classification enables all involved to save time and costs on litigation and on evaluation of habitat value (Bram *et al.* 2015).

Projects have successfully used the USNVC for development of state-and-transition models of landscape change (Kudray and Cooper 2005). There is no standard for defining states in these models and any model is vastly improved if its elements are well-defined; USNVC type descriptions serve this purpose. Further, USNVC types provide a baseline to delineate “novel” or “ruderal” communities resulting from invasions and climate change.

In addition, the USNVC has im-

proved mapping efforts. Developing habitat suitability maps and creating high-quality vegetation maps (Figure 1) is essential for biodiversity stewardship and research (Evens and Keeler-Wolf 2014), because conservation plans rely on maps of vegetation or habitat to identify and prioritize biotic landscapes for a network of all conservation elements (species’ habitats and rare communities). Reliable maps of critical habitat, wildlife corridors, and wetlands can all be standardized and quantitatively evaluated using the USNVC.

To support the USNVC, a public vegetation-plot database (VegBank; <http://vegbank.org>) was launched in 2004 (Peet *et al.* 2012). The purpose of archiving these records is not only to document the Classification and facilitate its revision and improvement, but also to allow scientists to answer questions from micro- to macro-scales. The database has already resulted in a regional analysis of longleaf pine (*Pinus palustris*) community types from Virginia to Florida (Palmquist *et al.* 2014). We urge everyone collecting vegetation-plot data that meet the USNVC standards to upload their data to a public archive such as VegBank, and to classify those plots following the USNVC. A second web database (www.usnvc.org) was launched in 2008 and contains search functions for all USNVC types.

We hope the letters from Schimel and Chadwick (2013) and ourselves stimulate the use and improvement of classifications. Although no classification will be applicable to all questions, having standards for data collection, analysis, and interpretation, as well as the classification scheme itself, offers ecological and economic advantages to large-scale research, management, and inventory. In addition, having a context for the variety of individual research and management efforts will improve our ability to place all these pieces into a consistent and more productive framework.

ESA Vegetation Classification Panel*

*For a complete list of authors, see

WebPanel 1; for correspondence, contact author Scott Franklin (Scott.Franklin@unco.edu)

- Bram D, Most M, Hymel K, and Dark S. 2015. A shared vision for the California Survey of Vegetation. Northridge, CA: Center for Geographical Studies, California State University.
- Evens J and Keeler-Wolf T. 2014. Vegetation mapping is essential in conserving rare desert plant species and plant communities. *Fremontia* 42: 11–14.
- Faber-Langendoen D, Keeler-Wolf T, Meidinger D, *et al.* 2014. EcoVeg: a new approach to vegetation description and classification. *Ecol Monogr* 84: 533–61.
- Faber-Langendoen D, Tart DL, and Crawford RH. 2009. Contours of the revised US National Vegetation Classification standard. *Bull Ecol Soc Am* 90: 87–93.
- FGDC (Federal Geographic Data Committee). 2008. National Vegetation Classification Standard, Version 2 FGDC-STD-005-2008. Reston, VA: Vegetation Subcommittee, Federal Geographic Data Committee, FGDC Secretariat, US Geological Survey.
- Franklin S, Faber-Langendoen D, Jennings M, *et al.* 2012. Building the United States National Vegetation Classification. *Annali di Botanica* 2: 1–9.
- Jennings MD, Faber-Langendoen D, Loucks OL, *et al.* 2009. Standards for associations and alliances of the US National Vegetation Classification. *Ecol Monogr* 79: 173–99.
- Kudray G and Cooper S. 2005. Linking the National Vegetation Classification System to NRCS ecological sites in southeastern Montana. Report prepared for the Bureau of Land Management by Montana Natural Heritage Program, Natural Resource Information System, Montana State Library. Helena, MT: Montana Natural Heritage Program.
- Matthews EM, Peet RK, and Weakley AS. 2011. Classification and description of alluvial plant communities of the Piedmont region. North Carolina, USA. *Appl Veg Sci* 14: 485–505.
- Palmquist KA, Peet RK, and Weakley AS. 2014. Changes in plant species richness following reduced fire frequency and drought in one of the most species-rich savannas in North America. *J Vegetation Sci* 25: 1426–37.
- Peet RK. 2008. A decade of effort by the ESA Vegetation Panel leads to a new federal standard. *Bull Ecol Soc Am* 89: 210–11.
- Peet RK, Lee MT, Jennings MD, and Faber-Langendoen D. 2012. VegBank – a permanent, open-access archive for vegetation-plot data. *Biodivers Ecol* 4: 233–41.
- Schimel J and Chadwick O. 2013. What’s in a name? The importance of soil taxonomy in ecology and biogeochemistry. *Front Ecol Environ* 11: 405–06.

doi:10.1890/15.WB.006