

# AN INITIATIVE FOR A STANDARDIZED CLASSIFICATION OF VEGETATION IN THE UNITED STATES: THE FLORISTIC LEVELS

## THE ECOLOGICAL SOCIETY OF AMERICA PANEL ON VEGETATION

### ABSTRACT

The vegetation of the United States has been changing due to natural processes and a variety of human interventions. In response to changes in land use, social and economic conflicts have increased, resulting in a demand for better and more timely information about the remaining natural and semi-natural vegetation and related biota. A desire to sustain the integrity of natural resources, and the need for more information, have stimulated vegetation classification and mapping in state and federal agencies, academic institutions, and non-governmental organizations.

A standardized, refereed, and widely used vegetation classification for the United States has become essential for effective research, planning and management of the nation's ecological systems. Without a nationwide standard, large databases from many different sources cannot be integrated, compared, or evaluated.

On October 22, 1997, Secretary of Interior Babbitt endorsed a the **Federal Geographic Data Committee's National Vegetation Classification Standards**. These standards provided a comprehensive structure for vegetation classification but provided details only for the higher order physiognomic levels of the classification. The details of the floristically-defined alliance and association levels of the classification were left undefined. To identify, describe, and document the thousands of associations and alliances at the floristic level, nationwide, requires establishment of standards for plot data, nomenclature, description, data management and review of proposed named units.

In "*An Initiative for a Standardized Classification of Vegetation in the United States*," the **Ecological Society of America's Panel on Vegetation Classification** is drafting standards it believes will meet the need for floristic levels of a **National Vegetation Classification (NVC)**. Earlier versions of the *Initiative* have been made available for comment by the vegetation science community. A revised version will be available this summer for further comment.

# VEGETATION CLASSIFICATION PANEL OF THE ECOLOGICAL SOCIETY OF AMERICA

---

David Glenn-Lewin, Chair

*Wichita State University*

Orie Loucks, Chair Emeritus

*Miami University of Ohio*

Michael Jennings, Vice-Chair

*USGS Biological Resources Division*

Marc Abrams

*Pennsylvania State University*

Michael Barbour

*University of California, Davis*

Ken Berg

*Bureau of Land Management*

David Brown

*Arizona State University*

Marilyn Buford

*U.S. Forest Service*

*Chair, FGDC Vegetation Subcommittee*

Antoni Damman

*Kansas State University*

Dennis Grossman

*The Nature Conservancy*

Gary Hartshorn

*Organization for Tropical Studies*

Robert Peet

*University of North Carolina, Chapel Hill*

Robert Pfister

*University of Montana*

Denice Shaw

*U.S. Environmental Protection Agency*

Ken Spaeth

*USDA Agricultural Research Service*

Stephen Talbot

*U.S. Fish and Wildlife Service*

Gary Waggoner

*USGS Biological Resources Division*

Joan Walker

*Southeastern Forest Experiment Station*

Marilyn Walker

*University of Alaska, Fairbanks*

---

The **Ecological Society of America (ESA) Panel on Vegetation Classification** provides impartial scientific expertise to public, professional and private partners in support of the development and use of a scientifically credible **National Vegetation Classification (NVC)**. The Panel's goals are to:

1. advance standardization of the NVC;
2. advance quality assurance of data in the NVC;
3. support applications of the NVC to management and conservation objectives;
4. foster and coordinate research in vegetation classification; and
5. promote understanding of North American vegetation classification information and its use to the national and international community.

Our specific objectives have been to provide a forum for the review of goals and standards for this classification, including nomenclature, structure, and definitions. These are needed to promote standardization of named units of vegetation, to provide an ongoing process of review for modification or additions of named units, to facilitate broad public access to information relating to a standardized vegetation classification system, and to identify areas for further research and development.

## LIST OF CONTRIBUTORS

Mark Abrams, *Pennsylvania State University*  
Mark Anderson, *The Nature Conservancy*  
Michael Barbour, *University of California, Davis*  
Rex Crawford, *The Nature Conservancy*  
Antoni Damman, *Kansas State University*  
Don Faber-Langendoen, *The Nature Conservancy*  
David Glenn-Lewin, *Wichita State University*  
Kathy Goodin, *The Nature Conservancy*  
David Graber, *USGS Biological Resources Division*  
Dennis Grossman, *The Nature Conservancy*  
Miles Hemstrom, *USDA Forest Service*  
Michael Jennings, *USGS BRD*  
Bruce Kahn, *University of Wisconsin-Madison*  
Ori Loucks, *Miami University at Ohio*  
Ken Metzler, *Connecticut Geological and Natural History Survey*  
William Michener, *Jones Ecological Research Ctr.*

Robert Peet, *University of North Carolina*  
J. Scott Peterson, *USDA NRCS*  
Robert Pfister, *University of Montana*  
Thomas Philippi, *Savannah River Ecology Lab*  
Marion Reid, *The Nature Conservancy*  
Rebecca Sharitz, *Savannah River Ecology Lab*  
Marie Louise Smith, *USDA Forest Service*  
Susan Stitt, *USGS Biological Resources Division*  
Stephen Talbot, *U.S. Fish and Wildlife Service*  
Miklos Udvardy, *California State University*  
Jan van Wagtendonk, *USGS BRD*  
Gary Waggoner, *USGS BRD*  
Joan Walker, *USFS SE Forest Experiment Station*  
Marilyn D. Walker, *University of Alaska/USFS*  
Alan Weakley, *The Nature Conservancy*  
Neil West, *Utah State University*  
Peter White, *University of North Carolina*

Lori Hiding, *Program Manager, Sustainable Biosphere Initiative*

---

**Acknowledgments.** The ESA Vegetation Classification Panel's activities have been funded by the Biological Resources Division of the U.S. Geological Survey and its Gap Analysis Program, the Federal Geographic Data Committee (FGDC), the National Science Foundation, the National Center for Ecological Analysis and Synthesis, the Environmental Protection Agency, the Bureau of Land Management, and the Army Environmental Policy Institute. Partial funding for the development of these standards was provided under the FGDC National Spatial Data Infrastructure Cooperative Agreement Program, Cooperative Agreement #98HQAG2127. The Sustainable Biosphere Initiative, the science programs office of ESA, provides support to the ESA Panel on Vegetation Classification.

# INTRODUCTION

A standardized, refereed, and widely used vegetation classification is urgently needed for effective planning, management, and research on the nation's ecological systems.

In “*An Initiative for a Standardized Classification of Vegetation in the United States*,” the **Ecological Society of America's Panel on Vegetation Classification** has drafted standards it believes are required for such a classification.

This classification will be used to:

- **Classify and catalog plant communities**,
- **Establish habitat and ecological relationships** among assemblages of species,
- **Predict ecological processes** such as productivity, successional patterns, or other complex properties of natural phenomena, and
- **Provide a consistent conceptual matrix** for understanding and communicating the ecological context of a biotic element or management decision.

We expect that such a classification system will play a prominent role in guiding research and resource conservation, extrapolating findings in ecosystem management and planning, and predicting outcomes of environmental change.

## NATIONAL VEGETATION CLASSIFICATION STRUCTURE

### Physiognomic

<u>Category</u>	<u>Example</u>
class . . . . .	Woodlands
subclass . . . . .	Mainly Evergreen Woodlands
group . . . . .	Evergreen Needle-leaved Woodlands
subgroup . . . . .	Natural/Seminatural
formation . . . . .	Evergreen Coniferous Woodlands with Rounded Crowns

### Floristic

alliance . . . . .	<i>Juniperus occidentalis</i>
association . . . . .	<i>Juniperus occidentalis</i> / <i>Artemesia tridentata</i>

# WHY A NATIONAL VEGETATION CLASSIFICATION?

- The **vegetation of the United States is changing** dramatically as a result of the intensity and extent of land use.
- **Some vegetation types have become imperiled** because of habitat loss or degradation, others have disappeared entirely.
- **Losses of vegetation types represent losses in habitat diversity**, leading to increases in the number of species in danger of extinction.
- **Losses of native vegetation have accelerated** in the past several decades and the rate will likely increase. Future losses may be caused by climate changes and atmospheric deposition. Conservation and preservation of the diversity of natural vegetation requires that the range of vegetation be identified and described.
- **Social and economic conflicts also have increased**, resulting in a demand for better and more timely information about the remaining natural and semi-natural environments.

A desire to sustain the integrity of our natural resources and a need for more information for planning and management have stimulated vegetation classification and mapping in state and federal agencies, academic institutions, and nongovernmental organizations. These coordinated activities are moving the United States toward its first fully functional, widely applied system of vegetation classification.

## VISION

**The Ecological Society of America (ESA)**, the pre-eminent society for ecologists in the United States, has joined with cooperating organizations to strengthen the emerging **National Vegetation Classification (NVC)** through cooperative development of standards and scientific review of the developing classification. In the *Initiative*, the **ESA Panel on Vegetation Classification** outlines standards for:

- **Field data acquisition,**
- **Terminology and documentation of vegetation types,**
- **Classification units, and**
- **Data management.**

In addition, a **framework for ongoing peer-review** of the system's described types is needed.

# MINIMUM STANDARDS FOR VEGETATION PLOT RECORDS

Development of the NVC requires the creation of a database containing empirical data on the floristic composition and structure of the vegetation.

Data needed to develop the NVC includes:

1. **Data on the floristic composition and structure** of vegetation that can be used to classify vegetation, and
2. **Data that can be used to determine the environmental setting, distribution, and successional position** of a vegetation type that can be used to refine the understanding of the vegetation pattern on a landscape.

## Collection of vegetation plot data

The purpose of field sampling for a vegetation classification is to:

1. **Describe the floristic composition and structure** of the plant communities,
2. **Describe the spatial and temporal variation** within plant communities,
3. **Determine the environmental and biotic characteristics** of the plant communities so that their ecology can be defined, and
4. **Establish the geographical and elevational range** of the plant communities recognized.

Sampling approaches and requirements are described in the *Initiative*.

# STANDARDS FOR VEGETATION PLOT DATA

Minimum standards indicate the minimum quality and amount of data needed to make a plot record useful for the NVC and minimum criteria for entry into the database.

Plot record data includes:

1. **Vegetation data** describing the floristic composition and structure of the vegetation;
2. **Site data** relating to environment, habitat, disturbance, and biotic conditions; and
3. **Metadata** pertaining to sampling (e.g., information on location, methods and collection time).

The *Initiative* details minimum standards for data collection on:

- **Floristic composition;**
- **Cover, frequency and basal area of individual species;**
- **Vertical structure of vegetation;**
- **Physiognomic composition of strata;**
- **Habitat and other environmental conditions; and**
- **Metadata.**

# STANDARDS FOR VEGETATION CLASSIFICATION AND DESCRIPTION

The *Initiative* defines standards for:

1. **Identifying vegetation units,**
2. **Describing the vegetation unit, and**
3. **Documenting the classification process.**

All three steps are necessary to establish and maintain a valid and widely accepted classification.

## ASSOCIATION

- The **fundamental unit** of vegetation in the NVC.
- A **plant community of definite floristic composition, uniform habitat conditions, and uniform physiognomy.**
- A **unit of existing vegetation** (not necessarily potential vegetation).
- An **assemblage of species that occurs repeatedly across the landscape** in similar environmental settings.

The classification of associations is primarily accomplished through stand-level comparisons of floristic composition that is sampled by detailed plot measurements. Depending upon the amount of standardized plot data, the methods involve a combination of quantitative and qualitative steps.

Standards for identifying vegetation associations are described in the *Initiative*.

# ALLIANCE

- An **abstract vegetation type defined by a group of plant associations** that share a uniform physiognomy and uniform habitat conditions and are characterized by one or more diagnostic species, at least one of which is found in the uppermost vegetation stratum.
- Determined both by the **floristic composition of the associations** it contains and by the **physiognomic-ecological characteristics of the formation** that it represents.

The concept of vegetation alliance presented here is distinct from that of Zurich-Montpellier system.

Standards for identifying vegetation alliances are described in the *Initiative*.

# STANDARDS FOR DATA MANAGEMENT AND DATABASE ARCHITECTURE

Information flow defines and holds together the many parts of the NVC.

The NVC database must be:

- **Continuously updated**,
- **Perfectly archived**, and
- **Publicly accessible** (viewable, searchable, and down-loadable using publicly available electronic tools).

Three databases are essential for a functioning NVC:

1. **Plots database**
2. **Classification database**
3. **Botanical nomenclature database**

## PLOTS DATABASE

To be scientifically credible, a vegetation classification must be based on representative plot data. A necessary step in developing the NVC will be the establishment of a national plot database linked to the NVC with internally consistent plot data that were recorded according to the standards described in the *Initiative*.

The information architecture and standards for the Plots Database are described in the *Initiative*. A pilot of the Plots Database is currently under development.

## CLASSIFICATION DATABASE

The Classification database will form the core of the NVC.

The information architecture and standards for the Classification Database are described in the *Initiative*. The ESA Panel is working with TNC to integrate NVC criteria into the developing Heritage Database Management System.

# BOTANICAL NOMENCLATURE DATABASE

The NVC uses botanical nomenclature in vegetation type names, community descriptions, and plot data. The NVC must incorporate a mechanism for efficient and frequent updating of botanical nomenclature and for resolving the ambiguity associated with multiple interpretations of scientific names.

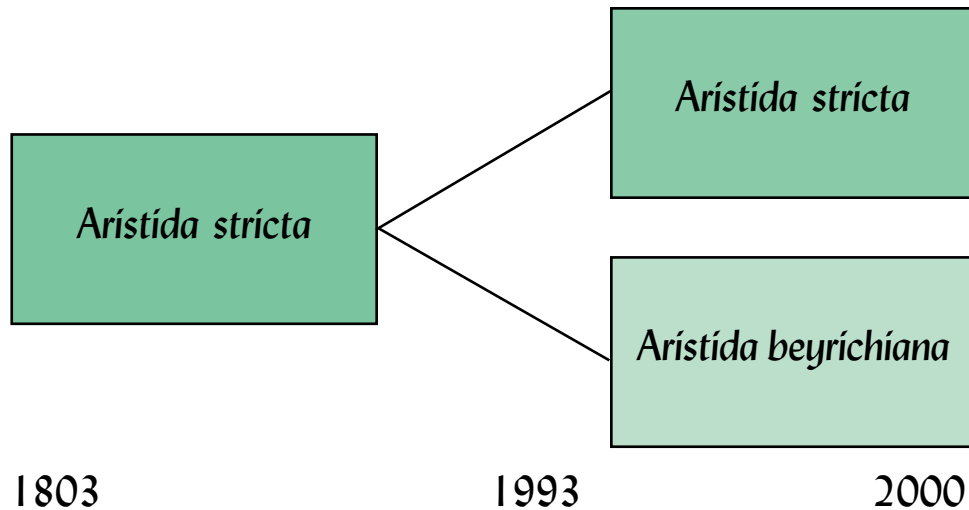
The information architecture and standards for the Botanical Nomenclature Database are described in the *Initiative*.

## DATABASE CHALLENGES

- The vegetation classification must be linked to and supported by a vegetation plots database.
- The plots database must support multiple forms of plot data and be available for public use and submission of data.
- The classification must be publicly available on the Internet.
- The classification must accommodate continual revision
- The classification as recognized at any time in the history of the database must be perfectly archived and viewable so as to allow citation in literature and legal contracts.
- References to organisms made at different times in different places by different authors should be unambiguous.

# TRADITIONAL BIOLOGICAL NOMENCLATURE IS INADEQUATE

Splitting one species into two illustrates the ambiguity often associated with scientific names. If you encounter the name *Aristida stricta* Michx. in a traditional database, you cannot be sure which of two meanings applies.



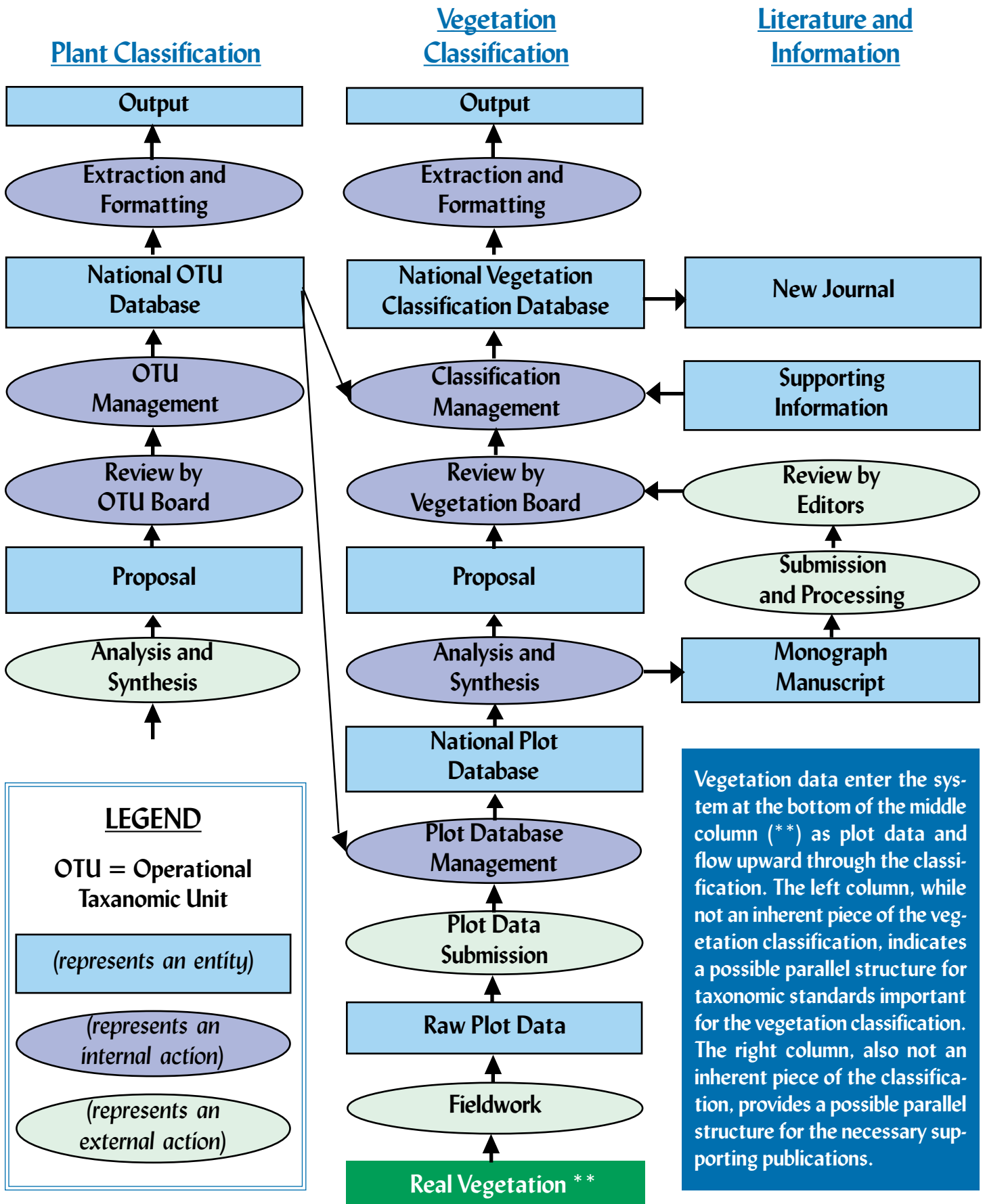
## LINNAEAN NOMENCLATURE: VERSION 2.0??

Database references to organisms and communities that derive from multiple times, places, and authors must take the form of a usage couplet that points to both name and description. Different standard classifications would refer to different usages in the same database.

<u>Names</u>	<u>Usages</u>	<u>Descriptions</u>
1. <i>Aristida stricta</i>	1-A: original (type) usage	A. Michaux 1803
2. <i>Aristida beyrichiana</i>	1-C: 2000 US/ITIS (national standard)	B. Trin & Ruprecht 1823
	2-B: original (type) usage	C. Peet 1993a
	2-D: 2000 US/ITIS (national standard)	D. Peet 1993b

# Proposed National Vegetation Classification

## Data Structure and Information Flow



# CONCLUSION

The standards for vegetation classification described in the *Initiative* provide the framework. The content that will become the NVC can only develop as new data become available and are evaluated in ways that yield a set of equivalent classes. New applications of the NVC are emerging every year and this will move vegetation science toward better classifications, as well as improvement of the standards described in the *Initiative*.

For more information on the activities of the ESA Panel on Vegetation Classification, see our website at <http://esa.sdsc.edu/vegwebpg.htm>.

# INITIATIVE FOR A STANDARDIZED CLASSIFICATION OF VEGETATION IN THE UNITED STATES: THE FLORISTIC LEVELS OF VEGETATION CLASSIFICATION

Ecological Society of America  
Panel on Vegetation Classification

## ABSTRACT

The vegetation of the United States has been changing due to natural processes and a variety of human interventions. In response to changes in land use, social and economic conflicts have increased, resulting in a demand for better and more timely information about the remaining natural and semi-natural vegetation and related biota. A desire to sustain the integrity of natural resources, and the need for more information, have stimulated vegetation classification and mapping in state and federal agencies, academic institutions, and non-governmental organizations.

A standardized, refereed, and widely used vegetation classification for the United States has become essential for effective research, planning and management of the nation's ecological systems. Without a nationwide standard, large databases from many different sources cannot be integrated, compared, or evaluated.

On October 22, 1997, Secretary of Interior Babbitt endorsed a the **Federal Geographic Data Committee's National Vegetation Classification Standards**. These standards provided a comprehensive structure for vegetation classification but provided details only for the higher order physiognomic levels of the classification. The details of the floristically-defined alliance and association levels of the classification were left undefined. To identify, describe, and document the thousands of associations and alliances at the floristic level, nationwide, requires establishment of standards for plot data, nomenclature, description, data management and review of proposed named units.

In "*An Initiative for a Standardized Classification of Vegetation in the United States*," the Ecological Society of America's **Panel on Vegetation Classification** is drafting standards it believes will meet the need for floristic levels of a National Vegetation Classification (NVC). Earlier versions of the *Initiative* have been made available for comment by the vegetation science community. A revised version will be available this summer for further review and comment.

## THE ESA PANEL ON VEGETATION CLASSIFICATION

The **Ecological Society of America (ESA) Panel on Vegetation Classification** provides impartial scientific expertise to public, professional and private partners in support of the development and use of a scientifically credible National Vegetation Classification (NVC). The Panel's goals are to:

1. advance standardization of the NVC;
2. advance quality assurance of data in the NVC;
3. support applications of the NVC to management and conservation objectives;
4. foster and coordinate research in vegetation classification; and
5. promote understanding of North American vegetation classification information and its use to the national and international community.

Our specific objectives have been to provide a forum for the review of goals and standards for this classification, including nomenclature, structure, and definitions. These are needed to promote standardization of named units of vegetation, to provide an ongoing process of review for modification or additions of named units, to facilitate broad public access to information relating to a standardized vegetation classification system, and to identify areas for further research and development.

#### OTHER PANEL ACTIVITIES

In August 1999, the Panel sponsored a workshop at the ESA Annual Meeting as part of its efforts to conduct outreach/educational activities on the developing standards. The 2-day workshop and field trip was attended by 48 vegetation scientists and practitioners and led by Panel members and local vegetation scientists. This workshop, "Using the Proposed National Standards for the Floristic Levels of Vegetation Classification in the United States: Associations and Alliances," allowed working professional vegetation scientists and active and educated users of vegetation classification to become more familiar with the proposed standards by providing them with an opportunity to work through vegetation classification exercises following the standards. The first day consisted of a field trip to several different sites to 1) review plot data collection standards and sampling methods, 2) obtain familiarity with vegetation in the area, and 3) identify vegetation types with a variety of local and regional vegetation classifications. The second day consisted of a working session in which participants 1) were introduced to the existing and developing national vegetation classification standards, 2) reclassified sets of local data using the new national vegetation classification system standards, 3) explored "crosswalks" of plots and types among different classification hierarchies, and 4) discussed the process for establishing new vegetation types. Experience with data sets from other areas of the country was presented to demonstrate recent experience in the application of the national classification system across a wide range of locations. In addition, a Poster Session allowed participants to demonstrate how they have been using the developing classification.

The Panel is currently developing a second workshop, "Moving Towards a National Vegetation Classification System: Where We Are and Where We Are Going" to be held at the ESA Annual Meeting in August 2000. It will expand on the previous workshop by looking at efforts to use the existing FGDC physiognomic-level vegetation standards, the developing floristic-level standards, and the developing National Vegetation Classification.

The Panel is working on the development of databases upon which the National Vegetation Classification will be based, including a plots record database and a database of vegetation types. Over the past several years the Panel has made important progress in developing the technical standards needed for a systematic floristic-level national vegetation classification, as has been adopted in concept by the Federal Geographic Data Committee. While some vegetation communities described under the emerging classification are based on field data, most are not. The greatest problem yet to be overcome is providing the quantitative data that are needed to describe those vegetation communities that have not been formally described using such data. In response to this problem, the Panel has developed a detailed project to develop a system of databases, titled "A perfectly archived, continuously updated database system for analysis of North American vegetation."

**For more information on the activities of the ESA Panel on Vegetation Classification, see our website at <http://esa.sdsc.edu/vegwebpg.htm>.**

The Ecological Society of America  
1707 H Street, NW, Suite 400  
Washington, DC 20006  
202-833-8773; 202-833-8775 fax  
esahq@esa.org; <http://esa.sdsc.edu>

