U.S. National Vegetation Classification: Advancing the Description and Management of the Nation's Ecosystems

United States National Vegetation Classification — USNVC

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

esa Panel on Vegetation Classification

Revising the USNVC using quantitative methods and plot data: A case study using longleaf pine (*Pinus palustris*) vegetation of the southeastern United States

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BACKGROUND AND GOALS

- The USNVC is a hierarchical vegetation classification system for the US (Fig. 1).
- The Federal Geographic Data Committee mandates that USNVC Alliances and Associations be based on analysis of publicly-available plot data.
- To date, few types have been defined using this standard.
- Longleaf pine (*Pinus palustris*) woodlands are represented by ~120 Associations and adequate description of these units is critical for effective conservation and management.

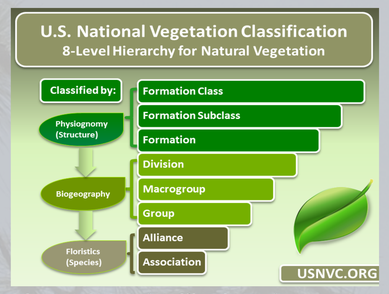

Fig. 1. USNVC classification scheme.

GOALS: Revise the USNVC longleaf pine Groups, Alliances, and Associations using a consistent analytical approach to document vegetation-environment relationships. Provide an example of use of plot data and quantitative methods to revise the established qualitatively-defined vegetation types.

ANALYTICAL APPROACH

DATA: 1101 longleaf pine vegetation plots (100 to 1000 m^2) distributed from Virginia to Florida. For each plot: presence of all vascular plant species and cover class codes. Soil properties for 90% of plots.

CLASSIFICATION METHODS: Utilized to define Groups, Alliances, and Associations.

Agglomerative hierarchical clustering with flexible β and multiple cluster numbers (2 to the number of existing types)

Presence-absence data | **Abundance data** — STEP 1

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Cluster validation: optpart and silhouette width — STEP 2

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Look for agreement between presence-absence & abundance-weighted clustering solutions — STEP 3

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Explore environmental-vegetation relationships using NMDS and mean soil properties for each cluster — STEP 4

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Interpret clusters, map them onto existing types in the USNVC or designate new types — STEP 5

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Generate constancy tables for each type and identify diagnostic species using indicator species analysis — STEP 6

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A CASE STUDY - REVISING USNVC LONGLEAF PINE GROUPS (G154, G009, G190, G596)

STEPS 1-3

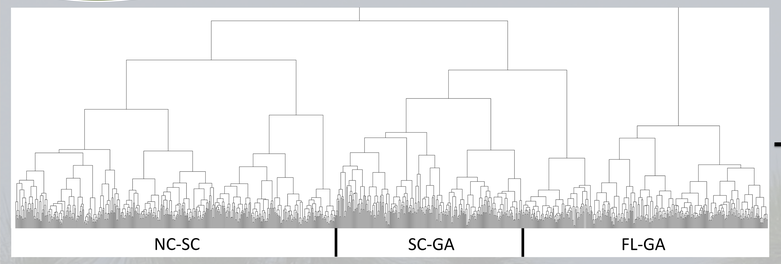

Fig. 2. Plots first sorted into coarse types based on geography (NC-SC, SC-GA, FL-GA), not according to Groups, due to high geographic turnover in species composition. As a result, we had to use both the clustering solution and expert opinion to parse plots into Groups.

STEP 4

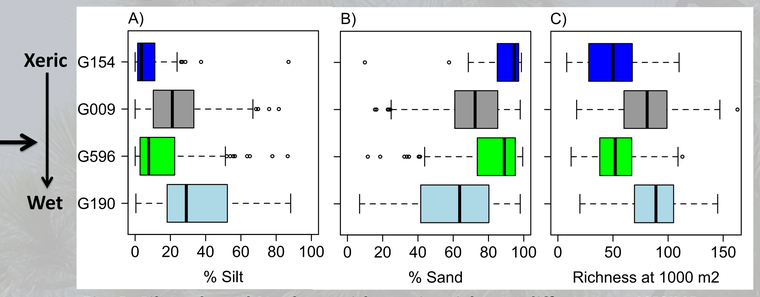

Fig. 3. Silt and sand %, along with species richness differ across USNVC Groups. Boxplots show the range and median values for plots of each Group.

A CASE STUDY - REVISING ASSOCIATIONS OF G154: XERIC LONGLEAF PINE WOODLAND

STEPS 1-4

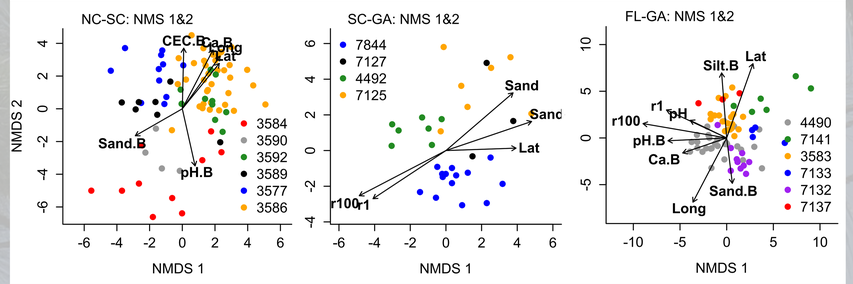

Fig. 4. Identified 178 plots and 17 Associations (each identified with a unique 4 digit code called a CEGL) that represent xeric and subxeric longleaf pine vegetation (G154) within three geographic bins that correspond to Alliances (NC-SC, SC-GA, FL-GA).

STEP 5

CEGL	N	Current Quantitative Association	Relationship	Previous Qualitative Association
7127	3	*Pinus palustris / Quercus laevis / Chrysoma pauciflosculosa / Aristida purpurascens* Woodland	≠	*Chrysoma pauciflosculosa* - (*Clinopodium coccineum*) Dwarf-shrubland
7125	7	*Pinus palustris / Quercus laevis – Quercus geminata / Schizachyrium scoparium* Woodland	≠	*Pinus palustris / Quercus laevis / Aristida purpurascens / Stipulicida setacea (Rhynchospora megalocarpa, Selaginella acanthonota)* Woodland
7844	14	*Pinus palustris / Quercus laevis / Schizachyrium scoparium – Stipulicida setacea* Woodland	=	*Pinus palustris / Quercus laevis - Quercus incana / Aristida beyrichiana - Baptisia perfoliata* Woodland
4492	7	*Pinus palustris / Quercus laevis – Q. margarettae / Licania michauxii / Aristida beyrichiana* Woodland	~	*Pinus palustris / Quercus laevis – Quercus incana / Quercus margarettiae / Licania michauxii / Aristida beyrichiana* Woodland

Table 1. Two clusters within the SC-GA Alliance represent modest (=) and significant (~) levels of refinement of existing Associations (7844, 4492). Two are new Associations (7127, 7125) that have some compositional affinities (≠) with previously defined types.

STEP 6

Association	7127		7125		7844		4492	
Tree species	**Const**	**Cov**	**Const**	**Cov**	**Const**	**Cov**	**Const**	**Cov**
Pinus palustris	100%	5	100%	6	86%	6	100%	6
Quercus hemisphaerica	100%	2	--	--	--	--	--	--
Quercus incana	--	--	--	--	79%	4	86%	3
Quercus laevis	100%	7	100%	6	100%	6	100%	6
Quercus margarettae	100%	5	--	--	--	--	71%	6
Shrub species	**Const**	**Cov**	**Const**	**Cov**	**Const**	**Cov**	**Const**	**Cov**
Gaylussacia dumosa	--	--	43%	6	71%	4	--	--
Licania michauxii	--	--	--	--	--	--	100%	3
Serenoa repens	--	--	--	--	--	--	71%	4
Herb species	**Const**	**Cov**	**Const**	**Cov**	**Const**	**Cov**	**Const**	**Cov**
[*Andropogon + Schizachyrium*]	100%	2	100%	4	100%	4	--	--
Aristida beyrichiana	--	--	--	--	64%	7	100%	5
Aristida purpurascens	100%	2	--	--	71%	2	--	--
Aureolaria pectinata	--	--	--	--	64%	2	86%	2
Cnidoscolus stimulosus	--	--	71%	2	71%	2	71%	2
Eriogonum tomentosum	--	--	--	--	64%	2	86%	2
Euphorbia ipecacuanhae	--	--	71%	2	57%	2	--	--
Liatris tenuifolia	--	--	--	--	--	--	71%	2
Pityopsis graminifolia	--	--	71%	2	93%	2	71%	2
Rhynchospora megalocarpa	--	--	71%	2	--	--	--	--
Stipulicida setacea	--	--	--	--	86%	2	--	--

Table 2. Mean species constancy (const) and cover class code (cov) for Associations in the SC-GA Alliance. Indicator species are highlighted in gray. Species are separated according to their growth form (tree, shrub, herb). Constant and indicator species were used to define Associations.

CHALLENGES AND OPPORTUNITIES

Challenge: Existing USNVC units vary in their origin, level of clarity and focus, and the amount of data, analysis, and experience behind them.

Challenge: In many regions, publicly-available vegetation plot data are limited and are largely unavailable from disturbed or managed lands. Where plot data are available, variation in field protocols and taxonomic standards makes data integration difficult.

Challenge: Quantitatively defined units often do not map cleanly on to existing types. This discordance may indicate a need to correct the boundaries of types, but it may simply be the result of continuous variation in vegetation.

Opportunity: The USNVC documents ecological context using a common language. Definition of vegetation types using quantitative data leads to consistent, data-driven descriptions that are useful for the management, conservation, and basic science sectors.

Opportunity: The broader user community is empowered to submit formal proposals for revision of vegetation types, thereby leading to improvement of the USNVC and recognition for these scholarly contributions.