Classification of Vegetation

Overview

- Like all biological systems, plant communities are temporally and spatially dynamic; they change at all possible scales.

- Dynamism in vegetation is defined primarily as changes in species composition and/or vegetation structure, as seen in this second year post-fire plant community.

Vegetation Structure

- Vegetation structure (Physiognomy) is determined by an interacting combination of environmental and historical factors, and species composition.

- It is characterized primarily by the horizontal and vertical distributions of plant biomass, particularly foliage biomass.

- Plants can be very uniformly spaced, as in a tree plantation, or very non-uniformly spaced. For example, in forests in rocky, mountainous terrain, areas of high and low tree density alternate depending on the spatial pattern of soil and climatic variables.

Vegetation Structure

- As a general rule, the larger an area under consideration, the more likely the vegetation will be heterogeneous across it. Two main factors are at work. First, the temporal dynamics of disturbance and succession are increasingly unlikely to be in synchrony across any given area as the size of that area increases.

- This meanss different areas will be at different developmental stages due to specific local histories, particularly the time interval since last major disturbance. This fact interacts with inherent environmental variability (e.g., in soils, climate, topography, etc.), which is also a function of area.

- Second, environmental variability constrains the suite of species that can occupy a particular habitat within a large area.

- These two factors--temporal dynamics and environmental variability-- interact to create a mosaic of vegetation conditions across the landscape. Therefore, in natural systems, there is always heterogeneity, although its scale and intensity will vary widely.

Vegetation classification vs mapping

- A classification system is not synonymous with a map legend. However, a classification system can be used to inform map legends and refine and improve mapping efforts.

    - **Vegetation classification** is the process of grouping similar stands together based on shared floristic and physiognomic characteristics, or in the case of image analysis, based on spectral response.

    - **Vegetation mapping** is the process of delineating landscape patterns of vegetation types and/or structural characteristics.

How is Vegetation Classified?

- In North America, vegetation classification is based on a combination of the following criteria: climate pattern, phenology and/or growth form, and dominant species.

- In the current National Vegetation Classification Standard, the classification is hierarchical and incorporates the non-floristic and general floristic criteria into the upper (most general) five levels, while limiting more specific floristic criteria only into the lower (most specific) two levels.

Classifying vegetation at continental to subregional scales

- Developing a consistent national vegetation classification system is crucial in modeling vegetation-environment interactions.

- Currently, there is a strong drive to model local, regional and global vegetation changes in response to global climate change, particularly changes in temperature, precipitation and disturbance regimes.

Goals of National Vegetation Classification Standard (NVC)

- Define and adopt standards for vegetation data collection and analysis
- Facilitate inter-agency collaboration and inter-agency product consistency
- Foster accuracy, consistency, and clarity in the structure, labeling, definition and application of a systematic vegetation classification for the U.S.
- Establish a national set of standards for classifying existing vegetation
- Develop minimum metadata requirements

Standard Comparisons

	FGDC 1997 - standard	Revised Hierarchy
1	CLASS	CLASS
2	SUBCLASS	SUBCLASS
3	FORMATION GROUP	FORMATION
4	FORMATION SUBGROUP	DIVISION
5	FORMATION	MACROGROUP
6	ALLIANCE	GROUP
7	ASSOCIATION	ALLIANCE
8		ASSOCIATION

New mid levels

NVC Hierarchy

VEGETATED AREAS	Natural Vegetation	Cultural Vegetation
Upper		
	Level 1-Formation Class	Level 1-Cultrual Class
	Level 2- Formation Subclass	Level 2-Cultrual Subclass
	Level 3- Formation	Level 3-Cultrual Formation
		Level 4-Cultrual Subformation
Mid		
	Level 4-Division	Level 5-Cultural Group
	Level 5-Macrogroup	Level 6-Cultural Subgroup
	Level 6-Group	
Lower		
	Level 7-Alliance	Level 7-Cultural Type
	Level 8-Association	Level 8-Cultural Subtype
NONVEGETATED AREAS	Not included in the NVC.	

Natural Vegetation Hierarchy

There are 8 classification levels based on 5 criteria:

- Diagnostic growth forms
- Dominant growth forms
- Compositional similarity
- Diagnostic species
- Dominant species

Summary of Upper-Level Units(1-3)

Formation Class
- Broad combination of dominant growth forms
- Global Moisture and temperature regimes and/or
- Substrate and aquatic conditions

Formation Subclass
- Combination of dominant and diagnostic growth forms
- Macroclimatic conditions driven by latitude/continentality and/or
- Substrate and aquatic conditions

Formation
- Combination of dominant and diagnostic growth forms
- Macroclimatic conditions such as elevation, seasonality of precipitation, and soil moisture conditions

Middle-Level Units (Level 4)

Division

- Combination of dominant and diagnostic growth forms and broad set of diagnostic plant taxa.

- Biogeographic differences in composition

- Continental differences in mesoclimate, geology, substrate, hydrology, and disturbance regimes.

Middle-Level Units (Level 5)

Macrogroup

- Combination of moderate sets of diagnostic plant species and diagnostic growth forms.
- Biogeographic differences in composition.
- Sub-continental to regional differences in mesoclimate, geology, substrate,hydrology, and disturbance regimes.

Middle-Level Units (Level 6)

Group

- Combination of relatively narrow sets of diagnostic species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms
- Biogeographic differences in mesoclimate, geology, substrate, hydrology, and disturbance regimes

Lower-Level Units (Level 7)

Alliance

- Characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, at least one of which is fond in the uppermost or dominant stratum of vegetation.

- Subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes.

- Consists of one or more associations.

Lower-Level Units (Level 8)

Association

- Characteristic range of species composition, habitat conditions, physiognomy and diagnostic species occurrence, typically at least one of which is found in the uppermost or dominant stratum of the vegetation.
- Topo-edaphic climate, substrates, hydrology, and disturbance regimes.

Association (Level 8)

- The Association, is the most precisely defined, and incorporates the names of the dominant one to three (usually two) species of the type.

- In practice, the levels of the macrogroup, group, alliance and/or association are the most often used, particularly in vegetation mapping.

Example of NVC Hiearchy

- Formation Class: Forest and Woodland
- Formation Subclass: Temperate Forest
- Formation: Cool Temperate Forest
- Division: Western North America Cool Temperate Forest
- Macrogroup: Northern Rocky Mountain Subboreal-Montane Forest
- Group: Northwestern Great Plains Aspen Forest and Woodland
- Alliance: *Populus tremuloides* Woodland Forest
- *Populus tremuloides/Osmorhiza occidentalis* Association

Crosswalking to the NVC

- Crosswalking to the middle and lower levels is necessary to refine and improve map products and to facilitate data sharing among agencies and partners.

- For example, the ecological systems classifications used by ReGAP, Landfire, and NatureServe can be crosswalked to or nested within the Macrogroup (Level 5), Group (Level 6) and Alliance (Level 7) levels of the new NVC hierarchy.

Application of NVC

- The NVC standard is ideally suited to guide data submission to support map correction and refinement.

- NVC-based standard data collection protocols allow for sharing of geospatial data resources and a much greater capacity to report on vegetation resources at the state, regional and national levels.

- Next, we will examine how ecologists obtain data to describe communities.

How ecologists describe vegetation

- Ecologists use standard plot methodologies for the collection of field data.

- These methods apply to vegetation mapping and directly relate to the development of vegetation classification and descriptions.

How ecologists describe vegetation

- Data collected to describe vegetation is complex because of the many species involved.

- Therefore, ecologists examine the different sources of variability in collected data and intend to use this to optimize data collection methods in order to adequately represent the sampled plant community.

How ecologists describe vegetation

- Ecologists primarily examine, interpret and describe the floristics of a sampled community.

- Floristic methods require intensive field sampling, detailed knowledge of the flora, and analysis of plot data to determine the constant or diagnostic species or groups of species.

- This data captures the floristics that reflect local and regional patterns of vegetation, thus refining the lowest, most detailed levels of the classification hierarchy.
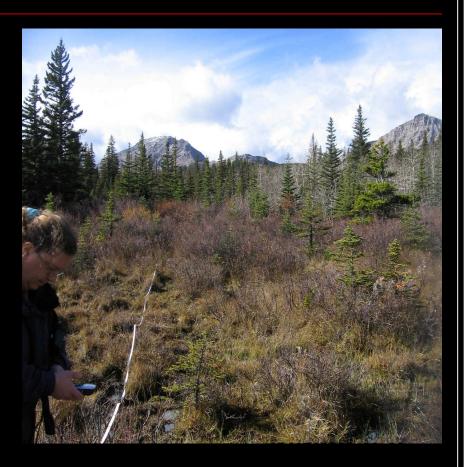
What is a plot?

- The purpose of plots is to record the vegetation and its environmental context. A plot may be contained by a single bounded area, such as a 50m x 20m rectangle. It could also consist of smaller subplots which sample vegetation over a large range or within a single, large macroplot.

- An observation is a one-time record of vegetation present in a plot. So multiple observations of a plot could be made at different times, producing different values for both vegetation present (which taxa are present and their abundance as well as environmental variables, such as soil characteristics).

Community vs. Site Based Sampling

- Given the extensive area covered by the classification, two methods --community-based and site-based-- are commonly used to allocate samples.

- *Community-based sampling* is used to refine the classification for a targeted group of related communities.

- *Site-based sampling* is used to identify and classify the communities on a given site by identifying units which are representative of the biological associations across the major environmental gradients.

Community-based sampling

- Data collection is focused on a particular alliance or broader group of related communities of interest and a detailed set of criteria for site inclusion are determined.

Community-based sampling

- For example, if sampling "fens" across Rocky Mountain States, the sampling might be restricted to communities which (1) are dominated by graminoids or shrubs, (2) occur in similar ecological setting (e.g., shallow to deep peat areas influenced by contact with basic groundwater), and (3) contain at least some members of a larger set of suspected characteristic species.

- In practice, restrictions are redefined as more is learned about the vegetation patterns.

Rocky Mountain Montane-Subalpine fen, Montana

Site-based sampling

- Site-based sampling divides the vegetated area into units that reflect important environmental and topographic gradients (e.g., slope, aspect, elevation, moisture regime, soil type).

- Transects that contain the strongest environmental gradients in a region are selected in order to optimize the amount of information gained in proportion to the time and effort spent during the vegetation survey.

- Once the major environmental gradients are identified, they are partitioned into environmental cells that reflect unique combinations of the variables. A subset of the cells that represent the entire range of variation of the site (wet-dry, low elevation-high elevation, disturbed-undisturbed, etc.) are then selected for more intensive sampling.

Sampling

■ Once sample sites are located (by either community-based or site-based methods), plots are placed in areas of homogenous vegetation which are determined to be representative of the vegetation type.

Stand selection and plot design

- A plot is established in a relatively homogenous unit of vegetation that is of sufficient size to represent the total species composition and abundance of the stand.

- Species composition and abundance, structure and canopy cover are measured to describe vegetation within the plot.

The objective of sampling is the characterization of vegetation types

- By using the NVC data collection protocol, individuals and agencies will be able to load their data to a publicly available database to allow for referencing and sharing of data.

- This in turn, will provide a means of improving and refining mapping efforts at finer scales.

Summary

- For specific information on using the NVC vegetation data plot protocol and standards, view the training presentation at the following link:

- www.mtnhp.org