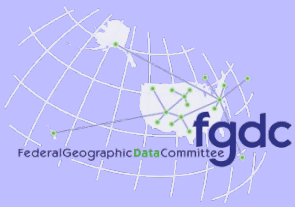


NSDI Standards

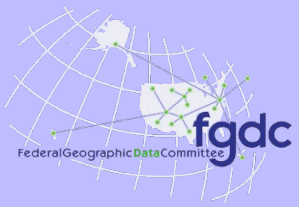
National Vegetation Classification Standard

An overview of the National Vegetation Classification Standard Version 2



Learning Objectives

- ▶ Benefits and importance of implementing FGDC standards
- ▶ Scope/structure of the National Vegetation Classification Standard (NVCS) v. 2
- ▶ Mechanisms to implement the NVC
- ▶ NVC data management and dissemination
- ▶ Sources of additional information for the NVC and other FGDC endorsed standards



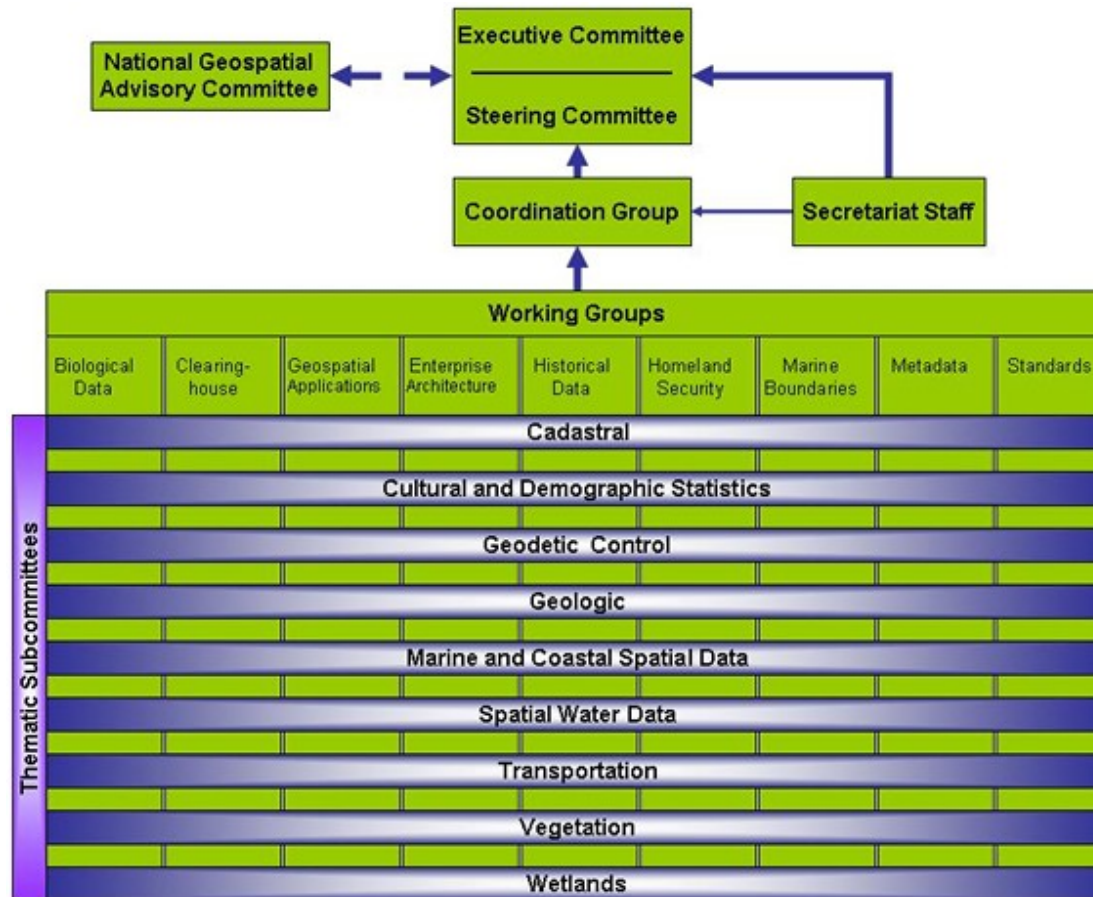
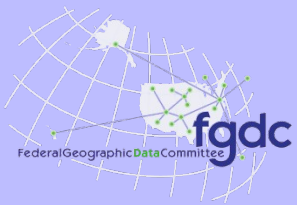
What is the Federal Geographic Data Committee?

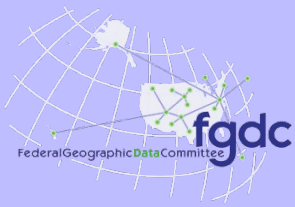
Federal Geographic Data Committee (FGDC)

- ▶ Interagency government committee
 - Promotes coordinated development, use, dissemination, and sharing of geospatial information

- ▶ Agency-led Subcommittees and Working Groups organized by data themes
 - Ten thematic subcommittees
 - Seven working groups

- ▶ Nationwide effort known as the National Spatial Data Infrastructure (NSDI)



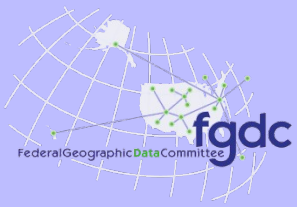


The Use of Standards

- ▶ Facilitates the development, sharing, and use of geospatial data

- ▶ Serve as documented agreements
 - Rules
 - Guidelines
 - Definitions of characteristics

- ▶ Executive Order 12906 (1994)
 - Mandates federal agencies collecting and producing geospatial data to do so in manner consistent with all relevant FGDC-adopted standards
 - Voluntary for non-federal agencies



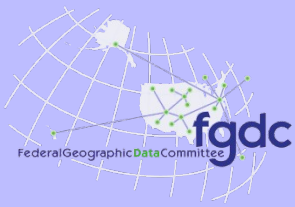
Twenty-two endorsed standards

- ▶ Data Exchange and Integration
 - e.g. Geospatial Metadata

- ▶ Cartography and Classification
 - e.g. Vegetation

- ▶ Thematic Content
 - Cadastral

An additional 19 standards are under development.

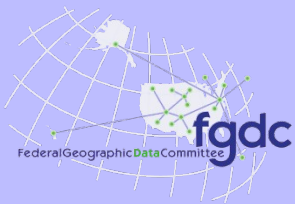


National Vegetation Classification Standard

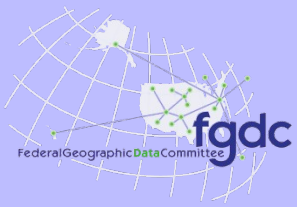
Formation of the FGDC Vegetation Subcommittee

- ▶ Charge: Developed a single vegetation classification and mapping standard for the United States
 - National Vegetation Classification (NVC) released in 1997
 - Version 2 formally endorsed by FGDC February 2008

- ▶ Facilitate/support development of standardized vegetation classification for the U.S. and its trust territories

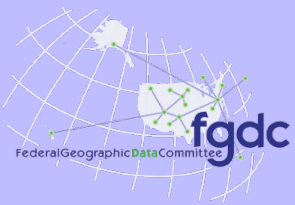


- ▶ Define and adopt standards for vegetation data collection and analysis
- ▶ Facilitate inter-agency collaboration and inter-agency product consistency
- ▶ Foster accuracy, consistency, and clarity in the structure, labeling, definition and application of a systematic vegetation for the U.S.
- ▶ Establish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

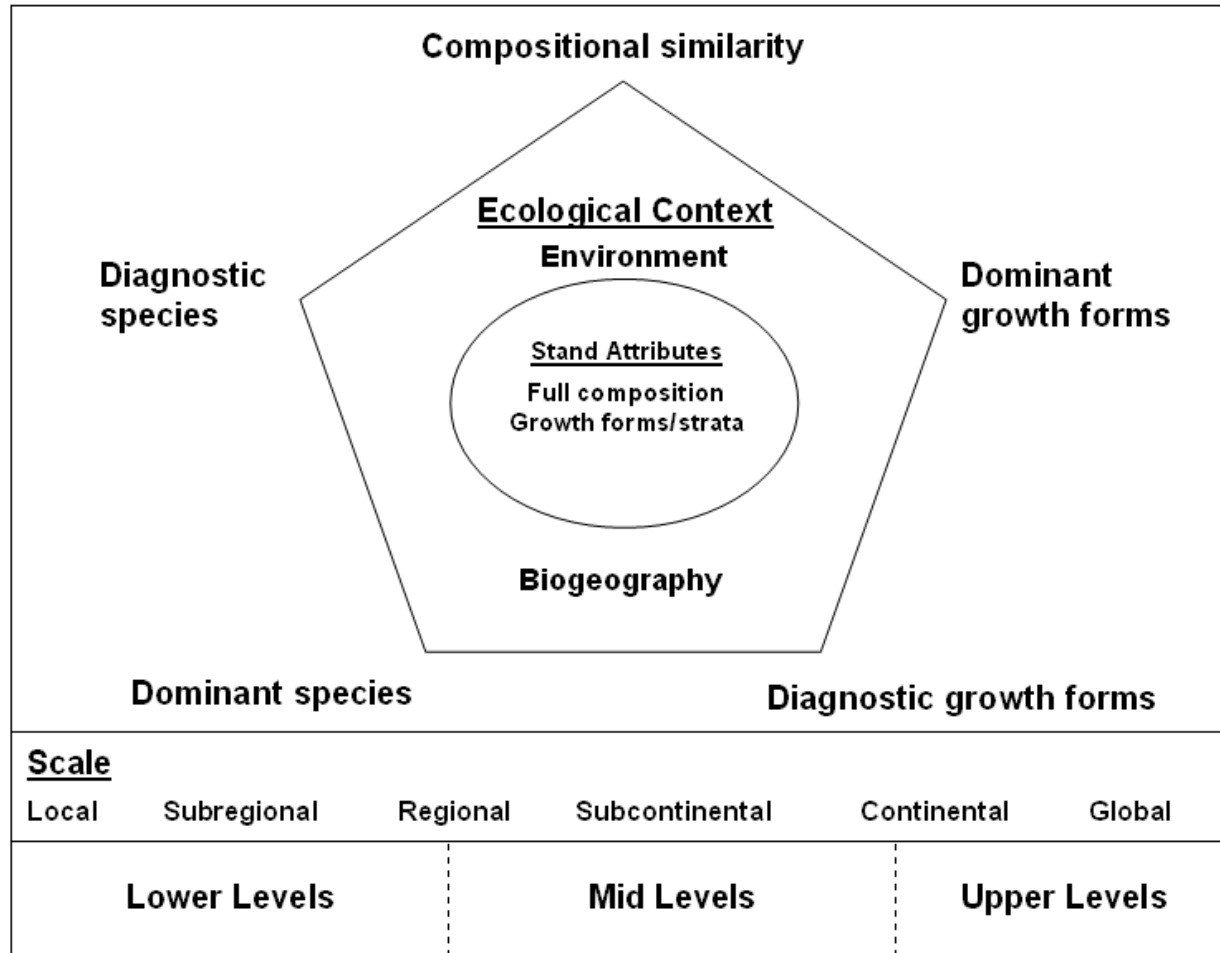


Hierarchical System

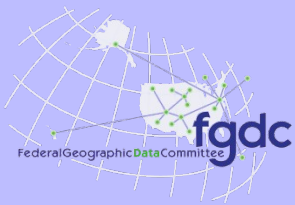
- ▶ Classifies existing vegetation based on both physiognomic and floristic criteria
- ▶ Differentiates between natural and cultural vegetation
- ▶ All areas having 1% of surface covered with living vegetation



Classification Criteria of NVC

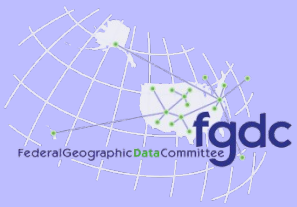


Source: FGDC (2008)



Hierarchical System

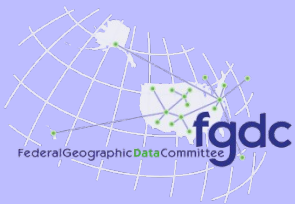
VEGETATED AREAS	Natural Vegetation	Cultural Vegetation
Upper		
	Level 1-Formation Class	Level 1-Cultural Class
	Level 2- Formation Subclass	Level 2-Cultural Subclass
	Level 3- Formation	Level 3-Cultural Formation
		Level 4-Cultural Subformation
Mid		
	Level 4-Division	Level 5-Cultural Group
	Level 5-Macrogroup	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

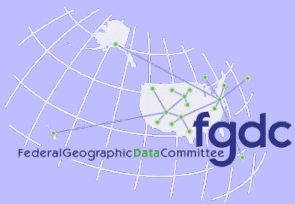
- ▶ Eight classification levels

- ▶ Five criteria
 - Diagnostic growth forms
 - Dominant growth forms
 - Compositional similarity
 - Diagnostic species
 - Dominant species



Upper-Level Units

- ▶ 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



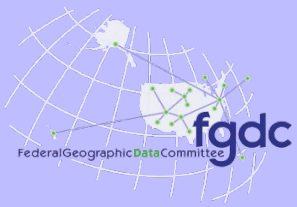
Middle-Level Units

▶ 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

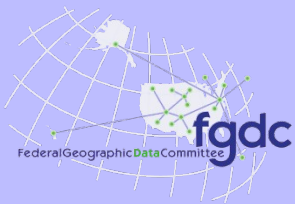
▶ Macrogroup

- 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 (cont.)

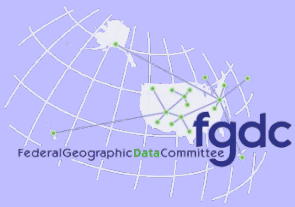
- ▶ Group
 - Combination of relatively narrow sets of diagnostic species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms
 - Biogeographic differences in mesoclimate, geology, substrate, hydrology, and disturbance regimes



Lower-Level Units

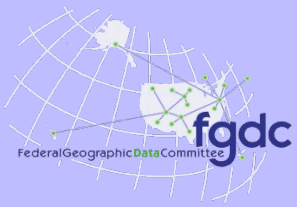
- ▶ Alliance
 - Characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, at least one of which is found in the uppermost or dominant stratum of vegetation
 - Subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes
 - Consists of one or more associations

- ▶ Association
 - Characteristic range of species composition, diagnostic species occurrence, habitat conditions, and physiognomy
 - Topo-edaphic climate, substrates, hydrology, and disturbance regimes



Examples

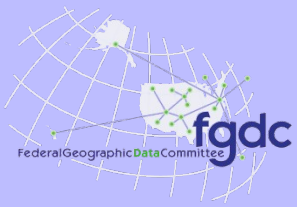
- Upper
 - Formation Class: Grassland and Shrubland
 - Formation Subclass: Temperate and Boreal Grassland and Shrubland
 - Formation: Temperate Grassland, Meadow and Shrubland
- Middle
 - Division: North American Great Plains Grassland and Shrubland
 - Macrogroup: Great Plains Mixed Grass Prairie Grassland and Shrubland
 - Group: Mixed Dry Grassland
- Lower
 - Alliance: Little Bluestem-Sideoats Grama Herbaceous Alliance
 - Association: Little Bluestem-Sideoats Grama-Threadleaf Sedge Herbaceous Vegetation



Cultural Vegetation

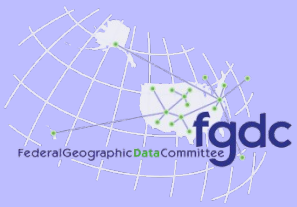
- ▶ Eight classification levels
 - Provides additional physiognomic level
 - Less interest on broad-scale biogeographic and climatic patterns

- ▶ Defined in varying degree by physiognomic and floristic criteria
 - Assessed in the context of anthropogenic activity



Upper-Level Units

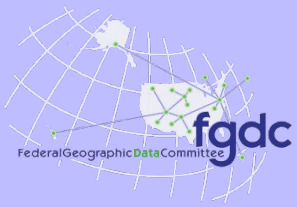
- ▶ Cultural Class
 - Characteristic combination of dominant growth forms adapted to relatively intensive anthropogenic manipulation
 - Relatively rapid changes in structure and composition
- ▶ Cultural Subclass
 - Combination and degree of herbaceous versus woody growth
- ▶ Cultural Formation
 - Dominant growth form of the canopy structure and whether annually converted or heavily manipulated/harvested
- ▶ Cultural Subformation
 - Spatial structure of vegetation and degree of manipulation of canopy



Middle-Level Units

- ▶ Cultural Group
 - Common set of growth forms and many diagnostic plant taxa sharing broadly similar region and climate and disturbance factors

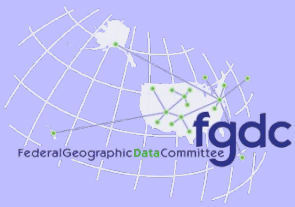
- ▶ Cultural Subgroup
 - Common set of growth forms and diagnostic species preferentially sharing of regional edaphic, topographic, and disturbance facts



Lower-Level Units

- ▶ Cultural Type
 - Common set of growth forms and many diagnostic plant taxa sharing broadly similar region and climate and disturbance factors

- ▶ Cultural Subtype
 - One or more dominant or co-dominant species in conjunction with a characteristic set of associated species, habitat conditions, and physiognomy

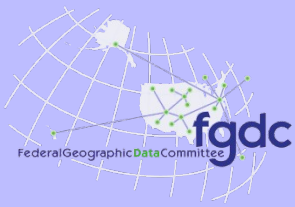


Examples

- Upper
 - Cultural Class: Agricultural Vegetation
 - Cultural Subclass: Herbaceous Agriculture Vegetation
 - Cultural Formation: Cultivated Crop
 - Cultural Subformation: Row Crop

- Middle
 - Cultural Group: Temperate Row Crop
 - Cultural Subgroup: Corn

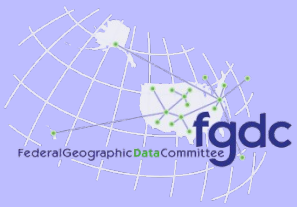
- Lower
 - Cultural Type: Sweet Corn
 - Cultural Subtype: Optional



Data Sources (Natural Vegetation)

- ▶ Field Plot Data (preferred)
 - To be collected and archived in a consistent manner
 - Must be publicly available
 - Based on quantitative analysis of field data

- ▶ Scientific Literature (acceptable)
 - To be used when field plot data is unavailable or limited
 - Use is to help expedite development of NVC
 - Goal to eventually rely solely on field plot data

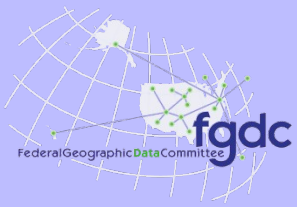


Stand Selection and Plot Design

- ▶ Should be established in relatively homogenous unit of vegetation

- ▶ Should be sufficient size:
 - To represent total species composition
 - To get an adequate measurement of species abundance

- ▶ Criteria for stand selection should be thoroughly documented
 - Metadata

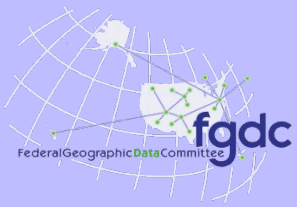


Species Composition of the Plot

- ▶ Name and dated taxonomic reference of all recorded taxa
 - If reference unknown, explicit statement stating such
 - Middle and lower tiers of the hierarchy (levels 4-8) require identification of genera, species, and finer taxa

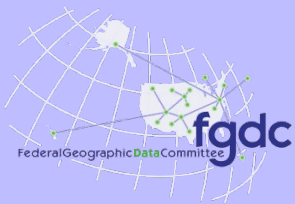
- ▶ Abundance of vascular plant species in plot
 - Measure of canopy cover

- ▶ Stratum or growth form
 - Each species in plot should be assigned to a stratum or a growth form
 - Estimates of abundance of each stratum or growth form also required



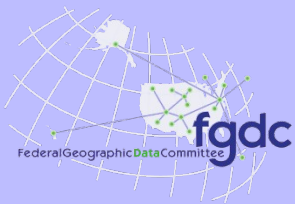
Vertical Structure of the Plot

- ▶ Strata and Growth Forms (levels 1-3)
 - Two equally permissible approaches
 - Describe growth forms, then subdivide these into size classes (layers)
 - Describe strata, then subdivide strata into growth forms
 - Each plant assigned to a stratum
 - Based first on height of plant
 - Based second on growth form of plant
 - Canopy cover of each stratum



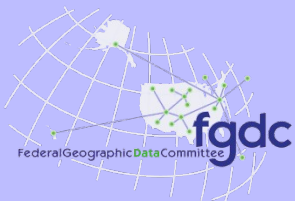
General Growth Form	Description
Trees	Woody plants, usually with a single main stem and a definite crown. In instances where growth form can not be determined, mature woody plants greater than 5 m in height shall be considered trees.
Shrubs	Woody plants that exhibit several erect, spreading, or prostrate stems that give a bushy appearance. In instances where growth form can not be determined, mature woody plants less than 5 m in height shall be considered shrubs.
Herbs	Nonvascular plants without significant woody tissue above the ground, with penetrating buds borne at or below the ground surface.
Nonvascular	Plant or plant-like organism without xylem and phloem (e.g. mosses, liverworts, lichens, and algae).
Floating	Rooted or drifting plants that float on the water surface
Submerged	Rooted or drifting plants that by-and-large remain submerged in the water column or on the aquatic bottom
Epiphyte	Vascular or nonvascular plant that does not root in the ground, but grows by germinating and rooting on other plants or structures
Liana	A woody climbing plant that relies on external structural support for height growth during part of its life. Typically exceeds 5 m in height or length at maturity

Source: Tart et al. (2005)



Stratum	Description
Tree Stratum	Vegetation layer in which woody plants are typically greater than 5 meters in height. Includes mature trees; shrubs over 5 meters in height; epiphytes, and lianas.
Shrubs Stratum	Vegetation layer where woody plants are typically between 0.5 m and 5 m in height. Includes shrubs, tree samplings, lianas, and epiphytes, but excludes rooted herbaceous vegetation over 0.5 m in height.
Field (Herb) Stratum	Vegetation layer consisting of herbs, regardless of height, and woody vegetation less than 0.5 m in height.
Nonvascular Stratum (Ground)	Vegetation layer consisting of nonvascular plants growing on soil or rock surfaces.
Floating Stratum	Vegetation layers in which rooted or drifting plants float on the water surface.
Submerged Stratum	Vegetation consisting of rooted or drifting plants that by-and-large remained submerged in the water column or on the aquatic bottom.

Source: Jennings et al. 2006

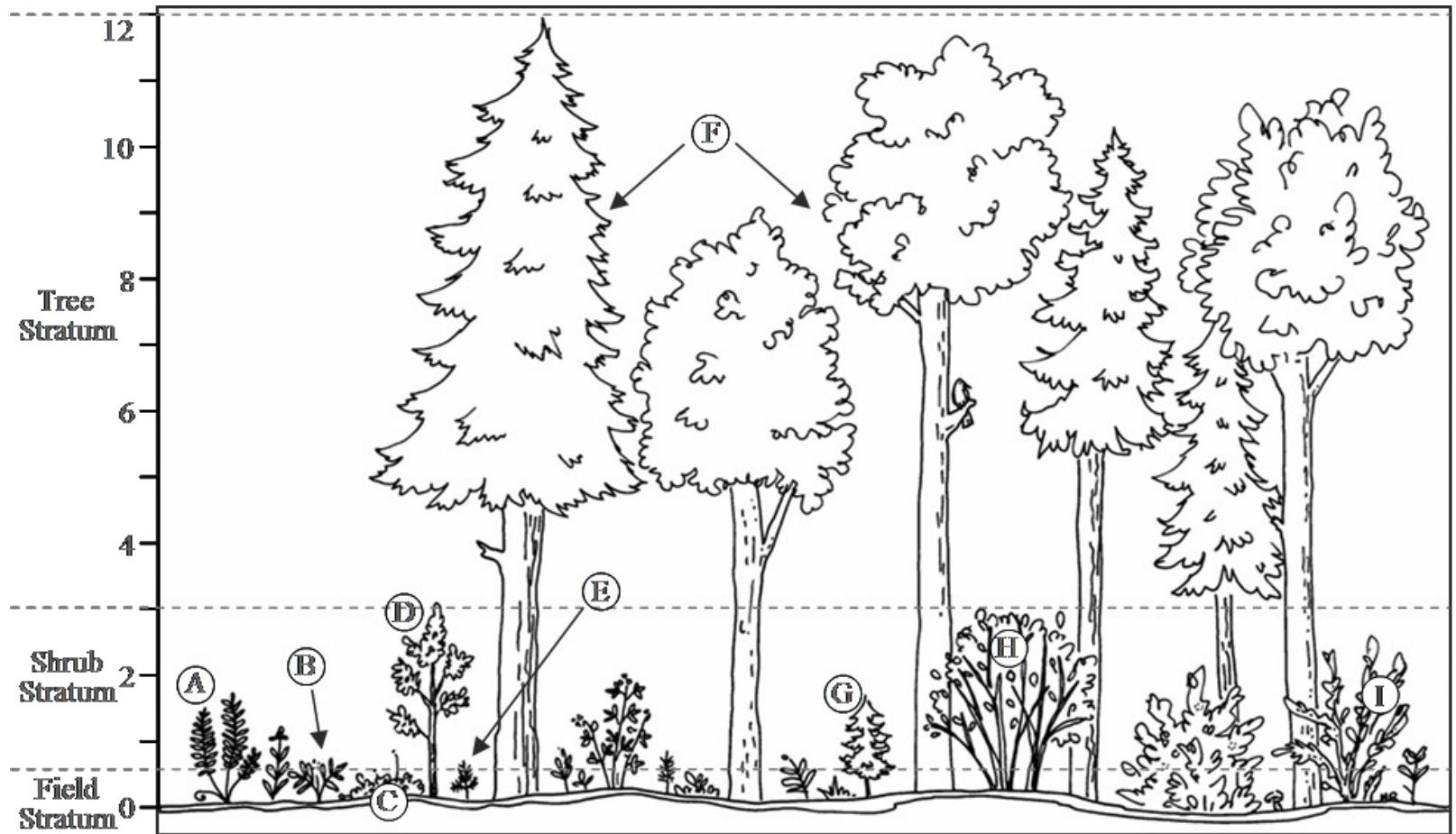


Strata and Growth Forms

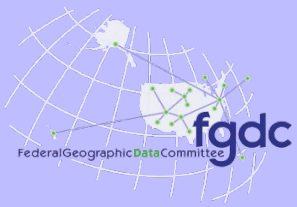
Stratum	Growth Form							
	Tree			Shrub			Herb	Non-vascular
	Size Classes:			Size Classes:				
	Regeneration		Over-story	Tall Shrub	Medium Shrub	Low Shrub		
Seedling	Sapling							
Tree Stratum			X	(X)				
Shrub Stratum	X	X		X	X			
Field (Herb) Stratum	X					X	X	
Nonvascular Stratum (Ground)								X
Floating Stratum							X	
Submerged Stratum							X	X

Source: FGDC (2008)

Strata and Growth Forms



Source: FGDC (2008)

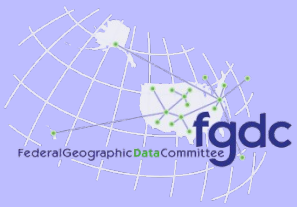


Physical Data of Plot

- ▶ Stand Physical Features
 - Landform; topographic position and geologic parent material

- ▶ Water and Soil Features
 - Water depth, water salinity, soil moisture, and drainage
 - Soil Surface Characteristics

- ▶ General Vegetation Characteristics
 - Landscape context, successional status, and evidence of disturbance
 - Homogeneity of vegetation

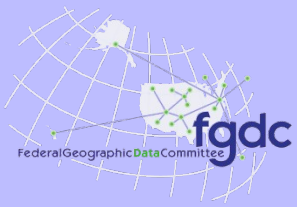


Geographic Data of Plot

- ▶ Location information
 - Longitude and latitude in decimal degrees and WGS 1984.
 - Coordinates and datum collected in field

- ▶ Location method/Accuracy
 - GPS, estimated from paper map or GIS, etc.
 - Estimate in radius in meters for 95% accuracy

- ▶ Location Narrative
 - Any additional information to help re-locate plot



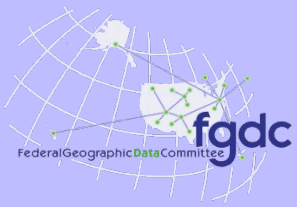
Metadata of Plot

- ▶ Author plot code
 - Unique identifier for plot

- ▶ Author observation code
 - For multiple observations; unique identifier

- ▶ Observation Date
 - Accuracy of date (low for historic data)

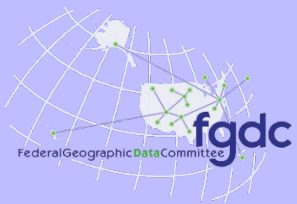
- ▶ Plot Selection
 - Approach taken to select plot



Metadata of Plot (cont.)

- ▶ Plot Characteristics
 - Plot area (m²)
 - Plot Type
 - Sampling in entire plot or within subplots?

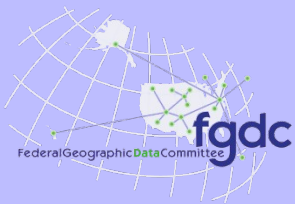
- ▶ Cover or abundance methodology
 - Species composition
 - Growth forms
 - Strata



Use of Literature and other Data Sources

- ▶ Published Literature
 - Limited to areas in which the NVC is weakly developed and/or
 - Vegetation type no longer available over its historic range

- ▶ Tabular Data
 - Plot data that has been summarized in tabular form, but original plot data no longer available
 - Data must meet minimum standards
 - Estimate in confidence of data

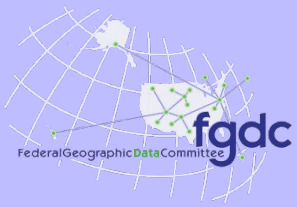


Data Management and Dissemination

- ▶ Taxonomic Dataset
 - Each taxon recorded as name-and-reference couplet
 - Growth form names based on specified references

- ▶ Plot Dataset
 - Stored in publicly available and searchable database
 - VegBank (www.vegbank.org)
 - Include all required metadata

- ▶ Vegetation Classification Dataset
 - Citation



Data Sources (Cultural Vegetation)

- ▶ Comprehensive Standards Forthcoming

- ▶ Acceptable Sources (higher levels of hierarchy)
 - Analysis of imagery
 - Thematic spatial Data Layers
 - Field Survey Data

- ▶ Acceptable Sources (lower levels of hierarchy)
 - Field Survey Data