Section 1: Existing Vegetation Classification and Mapping Framework

1.1 Introduction

The Forest Service manages 156 National Forests and 20 National Grasslands. These 191 million acres represent a variety of landscapes and ecosystems. Classification and mapping of vegetation are fundamental to the stewardship, conservation, and appropriate use of these resources.

Existing vegetation *is the plant cover, or floristic composition and vegetation structure, occurring at a given location at the current time*. Existing vegetation is the primary natural resource at the heart of almost everything the Forest service does. It is the resource on which the agency spends the most money for inventories and assessments. However, existing vegetation has historically lacked any consistent standards for classification and mapping. As a result, vegetation descriptions and maps have not been sharable across unit boundaries.

When classification and mapping of existing vegetation are undertaken, this protocol establishes Forest Service standards and procedures for those activities. This technical guide is authorized by Forest Service Manual (FSM) 1940 and has been developed according to direction in Forest Service Handbook (FSH) 1909.

Section 1 of this document should be read to provide context before reading sections 2 or 3.

1.11 Organization of Technical Guide

Section 1 of this technical guide describes the agency business needs that require existing vegetation information and the strategy and concepts of the protocol. Section 2 addresses floristic classification of existing vegetation and the relationship of floristic vegetation types to the Federal Geographic Data Committee (FGDC) 1997 physiognomic classification standard. Section 3 addresses hierarchical mapping of existing vegetation at multiple levels. Section 1 provides the overall context and strategy for sections 2 and 3. A glossary of terms is found on page 5-1.

This guide does not address quantitative inventory or monitoring of existing vegetation. It also does not address classification or mapping of potential natural vegetation (PNV). PNV classification and mapping protocols will be addressed in other technical guides.

1.12 Vegetation Classification Standards

The FGDC Vegetation Classification Standards (VCS) (FGDC 1997) established a hierarchical existing vegetation classification with nine levels. The seven upper levels are primarily based on physiognomy. The two lowest levels, alliance and association, are based on floristic attributes. This Forest Service vegetation classification protocol is compatible with the 1997 FGDC standards for physiognomic classification. It is also compatible, as much as possible, with the forthcoming FGDC floristic classification standards, which have been drafted by the Ecological Society of America's (ESA) Panel on Vegetation Classification (Jennings *et al*. 2003). Associations and alliances are defined in section 1.31. Classification criteria for associations and alliances are described in sections 2.24 and 2.25, respectively.

1.13 Vegetation Mapping Standards

There currently is no FGDC standard for vegetation mapping. This protocol provides standards for developing vegetation geospatial databases and associated maps at four hierarchical levels that support the various business functions of the agency.

Four hierarchical map levels are identified that represent a gradient of thematic and spatial detail. The coarsest level is designed to efficiently meet broad analysis needs while the finest level is designed to provide more geographically precise and detailed vegetation information. The four defined map levels will aid in determining the information generally necessary at various functional levels of the Forest Service and set the expectations for data content, consistency, and accuracy. Descriptions of each map level along with a summary of general characteristics, related functional areas, and supported business requirements are provided in section 1.322. Although local business needs may necessitate detailed mapping of non-vegetated areas, this protocol is not intended to provide comprehensive guidance on detailed mapping of non-vegetated units.

1.2 Background and Objectives

1.21 Uses of Existing Vegetation Information

Ecosystem assessment and land management planning at national and regional extents require consistent standards for classification and mapping of existing vegetation. A standardized existing vegetation classification system provides a consistent framework for cataloguing, describing, and communicating information about existing plant communities. The Forest Service cannot afford to develop a separate classification or map for each and every question land managers face. We must describe and map fundamental units of vegetation that can be interpreted to address numerous questions. The net value of using standardized existing vegetation classifications and maps is increased efficiency, accuracy, and defensibility of resource planning, implementation, and monitoring activities. Hierarchical classification and multi-level mapping of existing vegetation provide the appropriate level of detail for each issue. Existing vegetation classifications and maps provide much of the information needed to:

- Describe the variety of vegetation communities occupying an area.
- Characterize the effect of disturbances or management on species including threatened and endangered species and community distributions.
- Identify realistic objectives and related management opportunities.
- Document successional relationships and communities within PNV or ecological types.
- Streamline monitoring design and facilitate extrapolation of monitoring interpretations.
- Assess resource conditions, determine capability and suitability, and evaluate forest and rangeland health.
- Assess risks for invasive species, fire, insects, and disease.
- Develop and describe fire and fuels related analysis products (e.g. Fire Regime Condition Classes).
- Conduct project planning and watershed analysis, and predict activity outcomes at the project or Land and Resource Management Planning scales.
- More effectively communicate with our partners, stakeholders, and neighbors.

Implementation of Forest Service policies and regulations require knowledge about current vegetation composition, structure, and patterns that are provided through existing vegetation classifications and maps. Some examples follow:

- Sustainability - Planning Rules - 36 CFR 219) --Evaluating and describing current status of ecosystems and species diversity and viability.

- Suitability and capability - National Forest Management Act of 1976 (NFMA)(16 U.S.C. 1604(g)(3)(b)) - Evaluating and describing diversity of plant and animal communities based on the suitability and capability of the land area.

- Inventory of noxious weeds and desirable plants - FSM 2080.

- Rangeland Management - FSM 2210, FSH 2209.13, Chapter 90 - Existing vegetation composition and structure is used in conjunction with PNV to determine ecological status, describe diversity of habitats, and describe desired future conditions.

- Threatened/Endangered/Sensitive Species - FSM 2670 - Description of current habitats for plant and animal species based on current vegetation composition, structure and patterns.

- Benchmark Analysis - FSM 1922.12 - Benchmark analysis provides baseline data to formulate and analyze alternatives. Estimates of forests physical, biological, and technical capabilities to produce goods and services require existing vegetation information. Analysis is conducted according to 36 CFR 219.12 (e)(1).

1.22 Relation of Existing and Potential Natural Vegetation

Existing vegetation information by itself cannot answer questions about successional relationships, historical range of variation, productivity, habitat characteristics, and responses to management actions. These questions can only be addressed by combining information about PNV, existing vegetation, and stand history. An existing vegetation classification inherently lacks information on the above topics because it only describes the vegetation present at one point in time. The current plant community reflects the history of a site. That history often includes geologic events, geomorphic processes, climatic changes, migrations of plants and animals in and out of the area, natural disturbances, chance weather extremes, and numerous human activities. Because of these factors, existing vegetation seldom represents the potential under current environmental conditions.

Potential natural vegetation (PNV) is "*the vegetation…that would become established if all successional sequences were completed without interference by man under the present climatic and edaphic conditions….*" (adapted from Tuxen 1956 as cited in Mueller-Dombois and Ellenberg 1974). PNV classifications are based on existing vegetation, successional relationships, and environmental factors (*e.g.*, climate, geology, soil, *etc.*) considered together. This approach requires understanding of species autecology and successional dynamics of plant communities. PNV classification uses information on structure and composition similar to that needed for existing vegetation classification, but with greater emphasis on composition and successional relationships.

Existing vegetation and PNV classifications and maps are both important, but address different questions. They are best viewed as complementary and synergistic, rather than mutually exclusive. Existing and PNV classifications can be done together as shown by Mueggler's (1988) classification of aspen forests in the Intermountain Region. Many people request existing vegetation information, but expect it to include environmental and successional relationships without fully understanding the implications. In reality land managers need information about both existing and potential natural vegetation in order to assess resource conditions and evaluate management options.

1.23 Vegetation Classification Business Requirements

Classification *is the process of grouping of similar entities together into named types or classes based on shared characteristics*. Vegetation classification consists of grouping a potentially infinite number of stands or plots into relatively few vegetation types. A **vegetation type** is *a named category of plant community or vegetation defined on the basis of shared floristic and/or physiognomic characteristics, which distinguish it from other kinds of plant communities or vegetation*. Definition of vegetation types makes meaningful generalizations about each type possible; thus reducing complexity and furthering communication while maintaining meaningful differences among types.

To meet the business requirements of the Forest Service, a floristic classification of existing vegetation must have the following qualities:

1. The classification system must eventually encompass all plant communities on National Forest System and adjoining lands.

2. The classification system must be based on inherent vegetation attributes such as composition, dominance, physiognomy, and structure. Solely abiotic features cannot distinguish types.

3. The classification categories must be based on collection and analysis of plot data to ensure they are precisely defined and mutually exclusive.

4. The classification system must be hierarchical with varying levels of detail available to address management issues and guide vegetation mapping at multiple levels.

5. The classification categories must be clearly defined, exhaustive, and mutually exclusive to facilitate communication and sharing of information.

6. The classification system must employ a simple dichotomous key with unambiguous criteria so all users can consistently identify the vegetation types.

The above requirements constitute guiding principles for development of floristic vegetation types for use on National Forest System lands. These requirements are consistent with the FGDC's guiding principles for vegetation classification (FGDC 1997) listed in appendix 1A.

1.24 Vegetation Mapping Business Requirements

Vegetation mapping *is the process of delineating the geographic distribution, extent, and landscape patterns of vegetation types and/or structural characteristics*. Maps are the most convenient and universally understood means to graphically represent the spatial arrangement and relationships among features on the earth's surface (Mosby 1980). Accurate and up-to-date maps of existing vegetation are commonly used for inventorying, monitoring, and managing numerous resources on National Forests.

Consistent mapping of vegetation types requires that a scientific classification of existing vegetation be developed first because classification defines the entities to be mapped. Any map based on vaguely defined types is inconsistent, hard to validate, and difficult to compare with other vegetation maps. The knowledge gained and organized through the classification process helps determine what spatial vegetation information is needed to address land management issues. (See Tables 1.3 and 1.4 for more information on the relationship between classification and mapping.) Mapping may reveal gaps in a classification that require development of new vegetation types or refinement of existing types through additional data collection and analysis.

The most important part of designing and implementing a mapping project is establishing the mapping objectives in the context of the land management issues to be addressed. Selection of the level of vegetation type (*e.g*. association) and the structural characteristics (*e.g*., canopy cover) used to define the mapped categories are a direct function of vegetation mapping objectives. To meet the business requirements of the Forest Service, maps of existing vegetation must have the following qualities:

1. The vegetation characteristics used as map unit design criteria and their thematic resolution must be appropriate for depiction at the selected map level and the chosen level must be appropriate for the attributes.

2. The vegetation types or classes used in designing map units should be based on a classification of existing vegetation as described in section 1.23.

3. The floristic composition of map units must be described in terms of clearly defined existing vegetation types.

4. At any given mapping level, the floristic resolution should be based on the level of the existing vegetation hierarchy needed to address management issues.

5. To the degree possible, finer map units should be capable of aggregation into broader map units based on the vegetation classification hierarchy.

6. The mapping system must be hierarchical with varying levels of detail available to address management issues at multiple scales over extensive areas.

7. The map units must be mutually exclusive and exhaustive.

8. The mapping process must be repeatable and consistent.

9. The map product must be of suitable accuracy for its intended use(s).

The above requirements constitute guiding principles for mapping existing vegetation on National Forest System lands.

1.25 Protocol Objectives

The objective of this technical guide is to provide direction for the development of existing vegetation classification and map products that are consistent and continuous across the landscape and responsive to the business needs of the USDA Forest Service. The Forest Service is directed to manage vegetation for a variety of social and economic purposes while maintaining the integrity of ecosystem components and processes at national, regional, and local scales. This direction requires standardized vegetation maps at multiple scales across all National Forest System (NFS) lands. The most effective way to standardize vegetation mapping is to base map units at all scales on a standardized hierarchical vegetation classification. Doing so will enhance our ability to aggregate maps across large geographic areas for spatial analysis of national, regional, or multi-forest issues. Standardized vegetation classification and mapping will also facilitate developing and populating corporate databases.

1.3 Protocol Overview

The existing vegetation protocol consists of two distinct but related processes: classification and mapping. Vegetation classification defines and describes vegetation types based on physiognomy and floristic composition. Vegetation mapping spatially depicts the distribution and pattern of vegetation types and/or structural characteristics. Because of the limitations of mapping technology, there rarely is a one-to-one relationship between vegetation types and vegetation map units. Mapping entails trade-offs among resolution and accuracy, both thematic and spatial, and cost. The goal is constrained optimization, not perfection.

1.31 Vegetation Classification Concepts and Definitions

Classification *is the process of grouping of similar entities together into named types or classes based on selected shared characteristics*. Classification is a fundamental activity of science and an integral part of human thought and communication (Mill 1872, Buol *et al*. 1973, Gauch 1982). It is how we assimilate and organize information to produce knowledge. “When we have a definition for anything, when we really have studied its nature to the point where we can say that it is *this* and not *that*, we have achieved knowledge” (Gerstner 1980 as cited in Boice 1998). Classification is a form of inductive reasoning that “establishes general truths from a myriad of individual instances” (Trewartha 1968). Even if classification categories are conceptual or abstract rather than absolute facts, they still serve to formulate general truths based on numerous observations.

A **class** is “*a group of individuals or other units similar in selected properties and distinguished from all other classes of the same population by differences in these properties*” (Buol *et al*. 1973). The properties selected as the basis for grouping individuals into classes are called **differentiating characteristics** (Buol *et al*. 1973). There are two fundamental approaches to selecting differentiating characteristics; they produce two different kinds of classes (Mill 1872) and two different kinds of classifications (Buol *et al*. 1973, Pfister and Arno 1980, Soil Survey Staff 1999).

A **natural or scientific classification** is *a classification in which the differentiating criteria are selected in order to "bring out relationships of the most important properties of the population being classified, without reference to any single specified and applied objective*" (Buol *et al*. 1973). In developing a scientific classification, "all the attributes of a population are considered and those which have the greatest number of covariant or associated characteristics are selected as the ones to define and separate the various classes" (Buol *et al*. 1973). A set of classes developed through scientific classification is referred to as a **taxonomy** (Soil Survey Staff 1999). A **taxonomic unit** (or **taxon**) is *a class developed through the scientific classification process, or a class that is part of a taxonomy*.

A **technical classification** (or **technical grouping**) is *a classification in which the differentiating characteristics are selected* "*for a specific, applied, practical purpose*" (Buol *et al*. 1973, Pfister and Arno 1980). The resulting classes are called **technical groups**. In contrast to natural classifications, technical classifications are based on one or a few properties to meet a specific interpretive need, instead of considering all the properties of the population.

This technical guide provides direction for development of floristic taxonomic units and technical groups based on vegetation structure. Both types of classes are used for a wide variety of analysis applications, supporting the business needs of the agency.

1.311 Floristic Taxonomic Units

Vegetation classification consists of grouping a potentially infinite number of stands or plots into relatively few vegetation types. A **vegetation type** is *a named class of plant community or vegetation defined on the basis of selected shared floristic and/or physiognomic characteristics, which distinguish it from other classes of plant communities or vegetation*. Vegetation types are taxonomic units developed through the scientific classification process as described above. Scientific classification makes meaningful generalizations about each vegetation type possible; thus reducing complexity and furthering communication while maintaining meaningful differences among types (Pfister and Arno 1980). Members of a vegetation type (*e.g.,* plots or stands) should be more similar to each other (in aggregate) than they are to members of other vegetation types. Three different levels of vegetation taxonomy are widely used in scientific vegetation classification: association, alliance, and dominance type. They are defined below.

An **association** (or **plant association**) is *"a vegetation classification unit defined on the bases of a characteristic range of species composition, diagnostic species occurrence, habitat conditions, and physiognomy"* (Jennings *et al*. 2003). The FGDC standard specifies that the term "association refers to existing vegetation, not a potential vegetation type." In other words, the term association does not necessarily refer to a climax plant community. This usage predominates in vegetation ecology (Krebs 1972, Mueller-Dombois and Ellenberg 1974, Barbour *et al*. 1980, Collinson 1988). In contrast, the USDA Forest Service (1991) and Natural Resources Conservation Service (NRCS) (1997) have used the term 'plant association' to refer to a climax or potential natural plant community, following Daubenmire (1968). The FGDC standard mandates that term 'association' or 'plant association' not be used to imply a climax plant community. However, it is acceptable to classify PNV at the association level of vegetation taxonomy.

An **alliance** is "*a vegetation classification unit containing one or more associations and defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation*" (Jennings *et al*. 2003). Because an alliance is a grouping of associations, plot data must be collected and analyzed, and associations classified, before alliances can be defined. Classification of alliances, therefore, requires the same level of data collection as classification of associations.

A **dominance type** is "*a recurring plant community defined by the dominance of one or more species which are usually the most important ones in the uppermost or dominant layer of the community, but sometimes of a lower layer of higher coverage*" (Gabriel and Talbot 1984 as cited in Jennings *et al.* 2003). Dominance types have been widely used in the development of map units where remote sensing imagery is the primary basis for map feature delineation. "Determining dominance is relatively easy, requiring only a modest floristic knowledge. However, because dominant species often have a geographically and ecologically broad range, there can be substantial floristic and ecologic variation within any one dominance type" (Jennings et al. 2003). Dominance types can be developed more rapidly than associations or alliances, but normally provide less information for land managers.

1.312 Structural Technical Groups

Structural classes are technical groups developed to provide the basis for analysis applications and specific management interpretations. This protocol addresses the use of structural classes to describe and map three attributes of vegetation structure: vegetated cover, tree canopy closure, and overstory tree diameter. These attributes are defined below. The technical groups or classes used to describe these attributes are shown in Tables 3.5, 3.6, and 3.7, respectively.

Vegetated cover is defined here as *the relative percentages of non-overlapping vegetation cover, a birds eye view as seen from above in a delineated area*. Vegetated cover within a delineated area will not exceed 100%.

Tree canopy closure is defined here as *the total non-overlapping tree canopy in a delineated area as seen from above*. The sum of all tree canopy cover within a delineated area will not exceed 100%. Tree canopy closure below 10% is considered a non-tree type.

Overstory tree diameter is defined here as *the mean diameter at breast height (4.5 ft. 1.37 m. above the ground) for the trees forming the upper or uppermost canopy layer* (Helms 1998). Tree size class is determined by calculating the diameter (usually at breast height) of the tree of average basal area (Quadratic Mean Diameter or QMD) of the top story trees that contribute to canopy closure, tree cover as seen from a birds eye view from above. Top story trees are those trees receiving light from above and at least one side; these are the open grown, dominant, and codominant trees.

1.32 Vegetation Mapping Concepts and Definitions

Two fundamental mapping concepts are presented in the following sections and form the basis for the map product standards defined in section 3. These fundamental concepts are the relationship between vegetation classification and mapping and mapping at multiple levels to address differing information needs.

1.321 Relation of Vegetation Classification to Mapping

Consistent mapping of vegetation types requires that a vegetation classification be developed beforehand. **Vegetation mapping** *is the process of delineating the geographic distribution, extent, and landscape patterns of vegetation types and/or structural characteristics*. Patterns of vegetation types are best recognized after the types have been defined and described. Maps based on vaguely defined types are inconsistent, hard to validate, and difficult to compare with other vegetation maps.

A **vegetation map unit** is *a collection of areas defined and named the same in terms of their component taxonomic units and/or technical groups* (adapted from Soil Survey Division Staff 1993). Vegetation map units can be based on physiognomic or floristic taxonomic units and structural technical groups, or combinations of these. These taxonomic units and technical groups provide the basis for vegetation maps that are consistent with the mapping objectives, appropriate for the map level being produced, and within the limitations of mapping technology. Selecting the vegetation types and structural classes to be depicted by the map is accomplished through the **map unit design** process.

Map units are designed to provide information and interpretations to support resource management decisions and activities. The map unit design process establishes the criteria used to aggregate or differentiate vegetation taxonomic units and technical groups to define map units. A map unit is comprised of one or more taxonomic units or technical groups. The criteria used to aggregate or differentiate within physiognomic types, floristic types, or structural classes to form map units will depend on the purpose of, and the resources devoted to, any particular mapping project (Jennings *et al*. 2003). For example, map units designed to provide information on existing forest structure to characterize wildlife habitat or fuel condition would be based on a combination of tree canopy cover and overstory tree diameter technical groups. The map unit design process is more complex for vegetation types than for structural characteristics. The mapping standards for vegetation cover, tree canopy closure, and tree diameter described in Section 3 represent general-purpose map unit designs for each structural characteristic at all map levels; although local information needs may occasionally require exceeding the standards.

Map units are depicted on maps within map features. **Map features** are individual areas or delineations that are non-overlapping and geographically unique (*e.g.,* polygon delineations or region delineations). Typically, one map unit is repeated across the landscape in many individual map feature delineations. The map feature delineation process should be based on the map units identified in the map unit design process. A more detailed discussion and examples of the relationship among taxonomic units/technical groups, map units, and map features are included in section 3.22.

1.322 Map Levels

Maps are developed and used at multiple resolutions and are best represented by a hierarchical series of map products. These products are described within this guide as **map levels**. Four hierarchical map levels are identified that represent a gradient of thematic and spatial resolution. Table 1.2 illustrates the business requirements and applications and Table 1.3 characteristics of these map levels. The four map levels are as follows:

National - National is the coarsest level in the map hierarchy and is intended to store and depict data at a nationwide or global extent. Map products at this level will typically have broad map classes and coarse spatial representation. Products at this level may be developed programmatically or aggregated from existing lower level products where feasible.

Broad - Broad-level products are intended to support state, multi-state, or Regional information needs. Products at this level may be developed programmatically or aggregated from existing products.

Mid - Mid-level products are intended to support Forest and multi-forest information needs including Forest planning, Forest/Region resource assessment and monitoring, and fire/fuels modeling. Products at this level provide a synoptic, consistent view of existing vegetation across all ownerships within the map extent. They are typically developed programmatically from remotely sensed and field data. Standard base-level maps, where they exist, should be considered for integration into mid-level map products.

Base - Base-level products support local Forest and District information needs and represent the highest thematic detail and spatial accuracy. This is the level that would be expected for most project planning and implementation. Base-level information is the least likely to be spatially extensive due to the cost of development; however, it offers the most flexibility for upward integration within the map hierarchy. Products at this level are typically developed from large-scale remotely sensed data and field data.

These four map levels will aid in determining the information necessary for various organizational levels of the Forest Service and set the expectations for data content, consistency, accuracy, and development costs. The National level is intended to efficiently meet the broadest analysis needs while the Base level is intended to provide geographically precise and detailed vegetation information.

The four map levels differ in both thematic and spatial resolution. **Thematic resolution** is the *level of categorical detail present within a given map unit,* while **spatial resolution** is the *measure of sharpness or fineness in spatial detail*. To the extent possible, a nested thematic and spatial relationship should exist between map levels for geographically coincident map products. While a seamless data hierarchy may not be currently feasible across the entire agency, the objective is that maps developed across administrative units for similar purposes will be comparable and reliable for conjunctive analysis. It is expected that vegetation maps used by regional and national functions depict information consistent with local maps that follow this protocol. In practice, coarse data will sometimes be used locally and specific information used nationally. This emphasizes the need for data consistency and compatibility.

Table 1.2. Existing Vegetation Map Levels, Business Requirements and Applications

Map Level	Forest Service Program Areas	Forest Service Business Requirements	Ecological Unit Hierarchy	Ecological Analysis Scale (Range) ECOMAP 1997	Potential Natural Vegetation Classification	Existing Vegetation Classification	Existing Vegetation Map Unit Design	Existing Vegetation Map Product Examples	Data Sources/ Sampling Protocols	Map Extent
1 **National**	FIA, RPA, International Forestry, Fire, FHM	National Strategic Inventory (FIA Phase I), Forest Cover, Forest and Rangeland Health/Sustainability	Division Province	1:30,000,000 to 1:5,000,000; gen poly size 10,000-100,000 sq. mi.	Class and Subclass	NVCS Class and Subclass, MLRA	National Land Cover Database, NVCS Class + Subclass	National Land Cover Database	FHM, FIA, NRI	National (millions of square miles)
2 **Broad**	RPA, FIA, Fire, FHM	Bioregional Assessments, Conservation Strategies (Region/Subregion)	Section Subsection	1:7,500,000 to 1:250,000; gen poly size 10-1,000 sq. mi.	Series	Dominance Types, Alliances (example SRM, SAF cover types)	Dominance Type Groups, Alliance Groups	SAF Forest Type Map, GAP	FHM, FIA, NRI	Multi-state or State (20+ million acres)
3 **Mid**	Forest Planning and Monitoring, Fire, FIA	Forest/Mulit-forest Planning/Monitoring, 4th/5th HUC Watershed Assessments, National Fire Plan Implementation (Forest Level) Forest and Rangeland Health Assessments, Terrestrial and Aquatic Habitat Assessments	Land Type Association	1:250,000 to 1:60,000; gen poly size 1,000-10,000 acres	Series, Climax Plant Association (sensu Daubenmire)	Dominance Types, Alliances, (Associations optional where needed)	Dominance Types, Alliances, Alliance Groups and/or Complexes, Canopy Cover Groups, Size/Height Groups (e.g., VSS)	R5 CALVEG, CWHR, R1 SILC1 and 3, GAP, NWI	FIA Intensified Plots, Compartment Exams, Field Training Data Plots	Multi-forest or Forest (50,000+ Acres)
4 **Base**	Project Planning, Forest Plan Implementation, Land Treatments	Forest Plan Implementation Project Planning & Land Treatments • Fuel Treatments • Grazing Management • Timber Management • Habitat Management • *Etc.* Range Analysis Stand Exams Effectiveness Monitoring	Landtype, Landtype Phase	1:60,000 to 1:24,000; gen poly size <1000 acres	Climax Plant Associations and Phases (sensu Daubenmire)	Alliances, Associations	Alliances, Association, Association Complexes, Canopy Cover Classes, Size/Height Classes, Vertical and Horizontal Structure	Resource Photo Interpretation Maps, Stand Maps (e.g., R8 CISC, R2 CVU), Range Allotment Analysis Maps	Stand Exams, Rangeland Protocols, TEUI integrated Plots,	5th/6th HUC Watershed or Project Area (<50,000 Acres)

Table 1.3 Existing Vegetation Map Levels and Characteristics

Map Level	Typical Map Extent	Minimum Mapping Feature Area (acres)	Suggested Update Frequency	Required Physiognomic Map Attributes	Number of Required Total Tree Canopy Closure Classes	Number of Required Overstory Tree Diameter Classes	Required Floristic Map Attributes
National	National (millions of square miles)	500	5 to 10 years	Division, Order, and Class	0	None	None
Broad	Multi-state or State (20+ million acres)	20	5 to 10 years	Division, Order, Class and Subclass	3	None	Cover Types and Cover Type Groups
Mid	Multi-forest or Forest (50,000+ Acres)	5	1 to 5 years	Division, Order, Class and Subclass	4	5	Cover Types and Regional Dominance Types
Base	5th/6th HUC Watershed or Project area (<50,000 Acres)	5	1 year	Division, Order, Class and Subclass	10	7	Cover Types, Regional Dominance Types and Alliances

These four map levels are not intended to be the sole definitions of the vegetation map products required to meet the business needs of the Forest Service. The standards subsequently defined in section 3 for each map level are minimums required to achieve each level and can be exceeded spatially and/or thematically. Informational requirements may dictate the need for a vegetation map that contains elements of two map levels (e.g., mid and base), or include information not identified in the standards section of this protocol. In other words, these map levels should be viewed as guidelines, not constraints.

1.323 Relation of Map Levels to Map Scale

A brief discussion of map scale is necessary to discriminate the concepts of map level and map scale. Based on historical use in a vegetation-mapping context, it has become easy to incorrectly use the term scale when referring to the detail depicted on a map. The term **scale** describes *the proportion that defines the relationship of a map, image or photograph to that which it represents, such as distance on the ground* (Robinson *et al.* 1978). For example, on Forest Service primary base maps, a distance of one foot on the map represents 24,000 feet on the ground and is represented by the scale proportion of 1:24,000. Based on this definition, the term is only applicable when the representation is fixed as on a hard copy map or image. The term scale is not valid for geospatial datasets that have no fixed representation. Because geospatial datasets are the standard map products defined in section 3, the term map level replaces scale when identifying vegetation datasets that can be effectively displayed at multiple scales but contain specific thematic and spatial resolution.

1.4 Roles and Responsibilities

Forest Service responsibilities for resource inventory and monitoring are outlined in FSM 1940.04. Specific roles and responsibilities for classification and mapping of existing vegetation are as follows:

National

- Provide direction for classification and mapping of existing vegetation that meets the business needs of multiple disciplines.
- Develop classification and mapping standards for existing vegetation to facilitate compatibility of vegetation types and maps across regional lines.
- Ensure that corporate database systems support the existing vegetation business needs.
- Coordinate with the Forest Service Inventory and Monitoring Framework and interagency classification and mapping activities.
- Support and evaluate regional implementation of existing vegetation classification and mapping to ensure compliance with national standards.
- Ensure that existing vegetation classification is consistent with standards adopted by the FGDC.
- Provide direction on interim classification and mapping of vegetation prior to completion of the FGDC floristic classification standard.
- Ensure that Regions are collecting data using approved National Forest System codes.
- Correlate vegetation types among regions and ensure compatibility of descriptions across regional boundaries.
- Maintain a national existing vegetation classification website to facilitate correlation.

Regional

- Implement existing vegetation classification and mapping programs consistent with national standards and protocols and develop regional supplements as needed.
- Develop existing vegetation classifications and maps to support resource assessments, forest plan revisions, resource monitoring, and other business requirements as scheduled in the regional strategic inventory plan.
- Coordinate with external cooperators and neighboring Regions to correlate vegetation types.
- Conduct field reviews to ensure consistency and quality during accomplishment of performance measures and outcomes.
- Correlate vegetation types within the Region, maintain a list of types in NRIS, and track the status of vegetation classification and mapping within the Region.

Forest

- Implement the existing vegetation classification and mapping programs using national standards and protocols and regional supplements.
- Implement classification and mapping projects on schedule and within budget.
- Collect appropriate field data to classify existing vegetation according to FGDC standards.
- Provide quality control of data collection for classification and mapping projects. Train field crews to collect data consistent with established national protocols.
- Conduct accuracy assessments of existing vegetation maps.
- Ensure that vegetation classification and mapping information is used appropriately in forest planning, assessments, and project implementation.
- Coordinate with local cooperators and neighboring Forest Service administrative units to correlate vegetation types and maps.
- Correlate vegetation types within the Forest and track the status of vegetation classification and mapping within the Forest.
- Publish final reports for vegetation classification and mapping projects.
- Enter and store all field-collected data in the Natural Resource Information System (NRIS) database.

1.5 Relation to Other Federal Programs and Standards

This section describes the relationship of the Forest Service existing vegetation protocol to the FGDC Vegetation Classification Standards (FGDC 1997), other Forest Service inventory and monitoring protocols, and other federal and non-federal programs.

All federal agencies and programs that collect or produce vegetation data are under the policy jurisdiction of the FGDC. Relations between these programs are governed by their joint accountability to the FGDC (OMB 1990, FGDC 1997).

1.51 Relation to the FGDC National Vegetation Classification Standard

This protocol is designed to be compatible with the FGDC Vegetation Classification Standard (VCS) published in 1997. The objective of that standard is as follows:

> "The overall objective of the National Vegetation [Classification] Standard (NVCS) … is to support the use of a consistent national vegetation classification to produce uniform statistics in vegetation resources from vegetation cover data at the national level. It is important that, as agencies map or inventory vegetated Earth cover, they collect enough data accurately and precisely to translate it for national reporting, aggregation, and comparisons. Adoption of the NVCS in subsequent development and application of vegetation mapping schemes will facilitate the compilation of regional and national summaries." (FGDC 1997)

1.511 History and Authority of FGDC

Office of Management and Budget (OMB) Revised Circular A-16 established the FGDC in 1990 (October 1990). Its mission is to "promote the coordinated development, use, sharing, and dissemination of surveying, mapping, and related spatial data" (OMB 1990). The FGDC is authorized to "establish, in consultation with other federal agencies and appropriate organizations, such standards … as are necessary to carry out its government wide coordinating responsibilities" (OMB 1990).

Executive Order Number 12906 (Clinton 1994) designates the FGDC as the lead organization to coordinate the development of the National Spatial Data Infrastructure (NSDI), which is defined as "the technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data." The Executive Order authorizes the FGDC to develop the standards needed to implement the NSDI and requires federal agencies to meet those standards. The gravity of this responsibility is best demonstrated by quoting excerpts from Executive Order 12906:

> "NOW, THEREFORE, by the authority vested in me as President by the Constitution and the laws of the United States of America … it is ordered as follows: … Federal agencies collecting or producing geospatial data … shall ensure, prior to obligating funds for such activities, that data will be collected in a manner that *meets all relevant standards adopted through the FGDC process*." (emphasis added)

1.512 Types of FGDC Standards

The FGDC establishes two kinds of standards--data and process (FGDC 1996). **Data standards** "*describe objects, features or items that are collected, automated, or affected by activities or functions of agencies* . . . Data standards are semantic definitions that are structured in a model" (FGDC 1996). **Process standards** "… *describe how to do something, procedures to follow, methodologies to apply, procedures to present information, or business rules to follow to implement standards*" (FGDC 1996). There are five types of data standards and 10 types of process standards (FGDC 1996). Those relevant to existing vegetation classification are as follows:

> **Data Classification Standards** – "*Data classification standards provide groups or categories of data that serve an application* ... Examples are wetland and soil classifications" (FGDC 1996). In other words, a data classification standard specifies and defines a set of categories that must be used, or cross-walked to, by federal agencies. The physiognomic levels of the NVCS (FGDC 1997) are a data classification standard.
>
> **Classification Methodology Standards** – "*Classification methodology standards are the procedures to follow to implement a data classification standard. It describes how data are analyzed to produce a classification*" (FGDC 1996). In contrast to a data classification standard,

classification methodology standards specify how to develop a classification rather than specifying the categories of the classification. The floristic levels of the NVCS (FGDC 1997) will be addressed by a classification methodology standard.

1.513 Overview of the FGDC National Vegetation Classification Standard

The FGDC Vegetation Classification Standard (VCS) (FGDC 1997) establishes a hierarchical existing vegetation classification with nine levels. The top seven levels are primarily based on physiognomy. The two lowest levels, alliance and association, are based on floristic attributes. An overview of the NVCS physiognomic hierarchy (FGDC 1997) is provided in Appendix 1B. A draft key to the five uppermost physiognomic levels is included in appendix 1C.

The NVCS (FGDC 1997) provides data classification, data content, and data collection standards for the seven physiognomic levels of the NVCS. It specifies and defines the vegetation categories making up the physiognomic hierarchy and requires federal agencies to collect the data attributes needed to identify the physiognomic categories. The FGDC Vegetation Subcommittee is currently in the process of revising the physiognomic levels of the NVCS (FGDC 2001a).

The NVCS (FGDC 1997) provides minimal classification methodology, data collection, and quality assurance standards for the floristic levels of the hierarchy. It states, "A comprehensive list of the nation's floristic level vegetation types is currently a goal to be pursued in the long term application of this standard." The full development of the floristic classification methodology standards is currently underway as Part II of the current standard (FGDC 2001b). The Ecological Society of America's (ESA) Panel on Vegetation Classification has drafted the standards (Jennings *et al*. 2003).

To summarize, the NVCS (FGDC 1997) currently provides a data classification standard for physiognomic classification only. Part two of the standard will provide a classification methodology standard for the floristic levels--alliances and associations.

1.514 FGDC Vegetation Classification Requirements

The NVCS (FGDC 1997) states:

> "The purpose of the national standard is to require all federal vegetation classification efforts to have some core components that are the same across federal agencies to permit aggregating data from all federal agencies. The NVCS does not prevent local federal efforts from doing whatever they want to meet their specific purposes. *NVCS does require that when those local efforts are conducted, they are conducted in ways that, among whatever else they do, they provide the required core data*."
>
> (emphasis added)

The NVCS (FGDC 1997) further states, "The adopted standards must be followed by all federal agencies for data collected directly or indirectly (through grants, partnerships, or contracts)" (FGDC 1997). The FGDC physiognomic data requirement clearly applies to all protocols that involve classification or mapping of vegetation types. It also appears to apply to any inventory or monitoring protocol that identifies or documents vegetation types. "The NVCS requires federally supported vegetation classification activities to collect data in ways that permit the data to be useful for creating a classification according to NVCS requirements...." (FGDC 1997).

This Forest Service protocol requires collection of all vegetation attributes (*i.e*., "core data") needed to crosswalk field plots to the physiognomic categories of the NVCS (FGDC 1997). It does not require use of the FGDC physiognomic categories due to their impending revision (FGDC 2001a). The FGDC-required physiognomic attributes are described in section 2.42 of this guide.

The NVCS does not establish floristic data standards because "Currently the policy for applying the standard is only through the formation level" (FGDC 1997). The floristic data requirements of this protocol have been coordinated as much as possible with the proposed FGDC floristic classification methodology standard as drafted by the ESA Panel on Vegetation Classification (Jennings *et al*. 2003). All the vegetation attributes required by this protocol are described in section 2.4 of this guide.

Future FGDC revision of the physiognomic levels of the NVCS and formal FGDC adoption of a floristic classification methodology standard may necessitate revision of this technical guide. The revision procedures are described in section 1.6.

1.515 FGDC Classification and Forest Service Business Needs

The Forest Service is directed by Forest and Rangeland Resource Planning Act of 1974 to inventory all forestland of the United States and the National Forest Management Act of 1976, the inventory of National Forests. For inventory, forestland is define as those lands having at least 10 percent stocking or formerly having such tree cover, and occupying an area of at least an acre in size (USDA Forest Service 2002). For mapping, the agency defines forestland as having 10 percent canopy closure of trees. This mapping definition was adopted as an interagency standard with the development of the USGS Land Use Land Cover Classification System (Anderson *et al.* 1976). This is also consistent with the International Forestry definition of forestland. (UN-ECE/FAO 1997) NVCS physiognomic class of closed canopy forest is defined as 60 to 100 percent tree canopy closure, and the open tree canopy as 25 to 60 percent. Both of these classes are clearly forestlands under the Forest Service standard. However, a gap occurs from 10 to 25 percent tree canopy closure, thus the need for an additional physiognomic class to meet the Forest Service business need related to forest inventory, monitoring and land management planning. For this guide, an additional physiognomic mapping category of sparse tree canopy, defined as tree canopy closure from 10 to 25 percent, will be added to the physiognomic class level.

Additionally, arid shrublands in the western U.S. are commonly classified as shrubland types, as having shrub cover of 10 percent or greater (Hironaka *et al.* 1983, Mueggler *et al*. 1980.). In grassland communities, 5 to 10 percent shrub cover has been found to be of ecological significant in the classification and management of grasslands (Daubenmire 1970). NVCS physiognomic standards fail to recognize these two critical breaks at the physiognomic class level, using a 25 to 100 percent cover for both the shrubland and dwarf shrubland classes. To meet the inventory, mapping, and management business needs of the Forest Service, mapping categories for shrubland and dwarf shrubland will be redefined as shrub or dwarf shrub dominated lands with 10 to 100 percent shrub cover. Trees must be less than 10 percent canopy closure.

For grasslands, an additional physiognomic map category of herbaceous--shrub steppe will be added and defined as herbaceous life form dominated with 10 percent cover or greater, and shrub and or dwarf shrub life form of greater than or equal to 5 but less than 10 percent cover. The cover requirements for the herbaceous physiognomic class will also be lowered, and redefined for mapping as herbaceous life form dominated land with greater than or equal to 10 percent cover. Tree, shrub and or dwarf shrub life forms must be less than 10 percent. Using a 10 percent lower cover break for shrubland and grassland types is consistent with National Park Service, where several recent vegetation alliance and association level classifications have been completed for National Monuments, Devils Tower in Wyoming and Tuzigoot in Arizona, as well as Badlands National Park of South Dakota (USGS, National Park Service, 2002).

These modifications and additions to the NVCS physiognomic class level will allow the mapping of critical vegetation map unit categories necessary to fully meet the business needs of the agency.

1.52 Relation to Other Forest Service Inventory and Monitoring Protocols

The overall objective of Forest Service inventory and monitoring protocols "… is to provide the ecological, social, and economic information necessary for the Forest Service to achieve its mission to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations" (FSM 1940.02 draft). Inventory and monitoring of natural resources provide the ecological information required by the Forest Service mission. In this context, inventory and monitoring are two overarching processes, which can be defined as follows:

> **Inventory** is *the systematic acquisition, analysis, and organization of resource information needed for planning and implementing land management* (adapted from NRCS 1997).
>
> **Monitoring** is *the systematic collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives* (adapted from SRM 1989).

These two overarching processes are comprised of specific activities designed to answer basic resource questions. These questions and activities are described in table 1.3, which portrays the overall structure of the Forest Service Inventory and Monitoring Framework.

The inventory process includes three fundamental activities– classification, resource mapping, and quantitative inventory. These three activities produce basic information about ecosystems and/or individual resources. These accumulated data and organized knowledge are necessary to provide a credible scientific basis for establishing land management objectives that are biologically and physically attainable.

The monitoring process includes dynamic sampling and evaluation. Dynamic sampling measures changes in resources over time (Helms 1998). Evaluation compares these changes to management objectives, threshold values for sustainability, and/or trigger points that initiate specific management actions. The evaluation criteria and the sampling methods are based on the body of knowledge produced by the inventory process.

Classification and mapping of existing vegetation are related to quantitative vegetation inventory and vegetation monitoring. Table 1.4 describes each of these activities in terms specific to vegetation (instead of the generic terms in Table 1.3) and describes the relationships between them. It also lists other vegetation protocols and processes that are related to these four existing vegetation activities.

These include classification and mapping of PNV and historic vegetation, and some TEUI processes, as well as specific existing vegetation monitoring and quantitative inventory protocols.

The sampling methods employed by the protocols listed in Table 1.4 should be as similar as possible in order to facilitate information sharing and simplify development of corporate vegetation databases. Table 1.5 presents a generalized comparison of the sampling approaches used in classification, mapping, quantitative inventory, and monitoring of vegetation. It describes the kinds of attributes collected, selection of sampling locations, and precision of sampling method.

1.521 Relation to Forest Service TEUI Protocol

The existing vegetation classification protocol and Terrestrial Ecological Unit Inventory (TEUI) protocol should be used together to provide the ecological context for making land management decisions. Existing vegetation classification and maps describe current vegetation composition, structure, and patterns. TEUI provides ecological type classifications and defines land units where response to disturbance processes and land management actions are expected to be similar based on PNV and physical characteristics (*e.g.,* geology, climate, soil, and topography).

Existing vegetation classifications and maps when combined with ecological type classifications and ecological unit maps provide land managers a context for evaluating ecological conditions and resource values (*e.g*., wildlife habitat, forage, watershed conditions, and timber), and selecting appropriate land management practices based on ecosystem capability. Bourgeron *et al*. (1994) discuss relationships between biotic components and abiotic factors being important for predicting management response of ecosystems and landscapes under various management scenarios. Bailey *et al*. (1994) discuss the importance of combining existing vegetation maps with ecological unit maps delineating land areas with similar potential for management to effectively assess ecosystem health in land use planning.

Predicting vegetation response or change as a function of various management scenarios or natural disturbance regimes requires associating existing vegetation classifications with TEUI ecological type classifications and describing successional relationships and dynamics. This requires classification and description of the plant communities or vegetation states that may be associated with an ecological type. Succession models and state and transition diagrams are being used by a variety of resource managers and specialists to predict vegetation change in response to disturbance processes or management practices. The state and transition diagram (Westoby 1989, Stringham *et al*. 2001) is used to describe how different disturbances or management practices (*e.g*., fire, flooding, grazing, and insects), or stresses (*e.g*., drought, increased precipitation, climate change, and variability) affect changes or transitions from one plant community or state to another. Use of this existing vegetation classification protocol in development of state and transition models facilitates prediction of changes in vegetation composition, structure, and pattern. This improves the utility of TEUI for evaluation and determination of desired vegetation objectives.

Information derived from combining existing vegetation classification, descriptions, and maps with TEUI provides the basis for selecting suitable areas for land use activities, identifying and prioritizing areas for restoration activities, evaluating various land management alternatives, and predicting the affects of a given activity on ecosystem health and resource condition. Existing vegetation classification and maps describe the range of vegetation composition, structure, and plant diversity associated with ecological types. This information can be used by land managers to assess and describe existing and potential resource conditions, define and describe desired vegetation conditions, describe outcomes resulting from various management prescription scenarios, and communicate environmental affects of land management planning alternatives.

Section 2 of this technical guide describes the methods used to develop vegetation types that can be used to describe the plant communities and states associated with ecological types that are developed according to the TEUI Technical Guide.

Table 1.3. Inventory and Monitoring (I & M) Framework

Overarching I & M Process	Basic Resource Question	Specific I & M Activity
Inventory – The systematic acquisition, analysis, and organization of resource information needed for planning and implementing land management. (adapted from NRCS 1997)	**What is it?**	**Classification** – The grouping of similar entities together into named types or classes based on shared characteristics.
	Where is it?	**Resource Mapping** – The delineation of the geographic distribution, extent, and landscape patterns of resource types or attributes.
	How much is there?	**Quantitative Inventory** – The objective quantification of the amount, composition, condition, and/or productivity of resource types or parameters within specified levels of statistical precision. (adapted from Helms 1998)
Monitoring – The systematic collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives. (adapted from SRM 1989)	**How is it changing over time?**	**Dynamic Sampling** – The collection and analysis of resource data to measure changes in the amounts, spatial distribution, or condition of resource types or parameters over time. (adapted from Helms 1998)
	Is it moving toward or away from management objectives?	**Evaluation** – The comparison of dynamic sampling results to management objectives consisting of predetermined standards, expected norms, threshold values, and/or trigger points.

Table 1.4. Relation of Existing Vegetation I & M Activities To Other Forest Service Activities

	Existing Veg. Classification	Existing Veg. Mapping	Quantitative Veg. Inventory	Vegetation Monitoring
Basic Questions:	What is it?	Where is it?	How much is there?	Is it changing toward or away from management objectives?
Task or Activity:	Develop and describe vegetation types; create keys to distinguish between types.	Delineate geographic distribution, extent, patterns, and juxtaposition of vegetation types and/or attributes.	Estimate the amount of each vegetation type, or the values of vegetation attributes, within a specific area.	Detect changes over time in amounts of vegetation types or values of vegetation attributes, and compare them to management objectives.
Relationships Between Processes:	Classification is a prerequisite for each of the other three processes. The other processes, especially mapping, can help validate and refine a classification.	A standard vegetation classification should be used to develop a map legend and to design map units.	An inventory of vegetation types requires that a classification be developed first. An inventory can be generated from a map by summing acres of map units, polygons, or components.	Knowledge gained through classification, mapping, and quantitative inventory help develop evaluation criteria and monitoring methods. Repeated mapping or inventory can provide monitoring data.
Related Activities or Processes:	- PNV Classification - Ecological Type Classification - Historic Vegetation Classification	- PNV Mapping - LTA Mapping - Landtype Mapping - Landtype Phase Mapping - Historic Vegetation Mapping - Fire Regime Condition Class Mapping	- Forest Inventory and Analysis - Common Stand Exam - Riparian Inventory - Old Growth Inventory - Range Inventory	- Forest Health Monitoring - Range Monitoring - Riparian Monitoring - Invasive Weed Monitoring - TES Plant Monitoring

1.53 Relation to other Federal Programs and Standards

All federal agencies are required by Executive Order 12906 (Clinton 1994) to comply with FGDC standards (see section 1.511). Coordination of existing vegetation classification efforts among agencies is possible only to the extent that each agency complies with the NVCS (FGDC 1997). As lead agency for the NSDI vegetation theme (OMB 1990) and chair of the FGDC Vegetation Subcommittee (FGDC 1997), the Forest Service must make every effort to include all affected federal agencies in the development and implementation of the NVCS.

Table 1.5. Comparison of Sampling Approaches for Existing Vegetation I & M Activities

	Existing Veg. Classification	Existing Veg. Mapping	Quantitative Veg. Inventory	Vegetation Monitoring
Task or Activity:	Develop and describe vegetation types; create keys to distinguish between types.	Delineate geographic distribution, extent, patterns, and juxtaposition of vegetation types and/or attributes.	Estimate the amount of each vegetation type, or the values of vegetation attributes, within a specific area.	Detect changes over time in amounts of vegetation types or values of vegetation attributes, and compare them to management objectives.
Example Attributes:	Physiognomy Floristics Composition Structure	Vegetation Types Plant Size Classes Canopy Cover	Vegetation Types Plant Size Classes Canopy Cover Productivity "Health Indicators"	Vegetation Types Plant Size Classes Canopy Cover Productivity "Health Indicators"
Sample Location Method:	**Subjective** Uniform stand and site conditions, not ecotonal. **Objective** Systematic placement along environmental gradients, or random.	**Subjective** Representative of a polygon or map unit. **Objective** Systematic or random within a polygon or map unit.	**Subjective** *Usually not appropriate.* **Objective** Random or systematic to provide statistical reliability.	**Subjective** Located in key areas of concern. **Objective** Located randomly or systematically within key areas.
Sampling Methods:	Reconnaissance or intensive. Vegetation and environmental data required for identifying relationships.	Reconnaissance or intensive. Both vegetation and environmental data usually collected.	Usually intensive. Usually requires only vegetation data. Methods depend on objectives.	Usually intensive. Data collected depends on what is being monitored.

1.54 Relation to Non-Federal Programs and Standards

FGDC standards are mandatory only for federal agencies, but non-federal governments and private organizations are encouraged to participate in the continued development of the NVCS (OMB 1990, Clinton 1994, FGDC 1997). As lead agency for the NDSI vegetation theme (OMB 1990) and chair of the FGDC Vegetation Subcommittee (FGDC 1997), the Forest Service must make every effort to include all interested non-federal organizations in the development and implementation of the NVCS.

1.6 Change Management

Process: this technical guide will be periodically updated based on interdisciplinary consultations and the results of testing the products of the guide. Stimuli for change will include results of national and regional field reviews, usage, and recommendations submitted to the national program manager from the field.

Supplements: Supplementation of the protocol is delegated to Regions but not to Forest and Grassland Supervisors. Regions may supplement the information in this technical guide with methods or guidance required for meeting specific issues or needs of the Region, and as FGDC standards and other programs change.

Review: A cadre of experts will conduct a periodic review to determine how and when to make changes. The classification and mapping protocols will be refined through a process of peer review. This will be a continuous process coordinated by the Washington Office Ecosystem Management Staff.

Update schedule: After the protocol is finalized, the Existing Vegetation Mapping Technical Guide will be updated as directed by the Washington Office Ecosystem Management Staff.