



Existing Vegetation Classification, Mapping, and Inventory



Business Requirements Analysis

Version 2.2 – November 10, 2011

Contents

1.0	Introduction.....	1
1.1	Business Requirements Analysis Process	1
1.2	Business Case	2
1.3	Summary.....	3
2.0	Management Requirements	4
2.1	Vegetation Resource Management	4
2.1.1	Statutes	4
2.1.2	Regulations, Executive Orders and Departmental Policy.....	8
2.2	Planning and Environmental Compliance.....	10
2.2.1	Statutes	10
2.2.2	Regulations, Executive Orders and Departmental Policy.....	11
2.3	Resource Information Management	11
2.3.1	Statutes	11
2.3.2	Executive Orders, Regulations and Departmental Policy.....	17
2.4	Summary.....	18
3.0	Inventory and Monitoring Scale/Data Relationships	19
3.1	Agency Decision Making Scales	19
3.2	FGDC Standards	21
4.0	Management Questions.....	22
4.1	Federal and Agency Standards and Policy Changes.....	22
4.1.1	Federal Geographic Data Standard	23
4.1.2	Agency Policy Changes	23
4.2	Review and Evaluation Recommendations	23
4.2.1	Classification, Mapping and Inventory Workshop Recommendations.....	23
4.2.2	LANDFIRE General Management Evaluation	25
4.2.3	California FRAP Review	26
4.3	Analysis and Evaluation Methods.....	27
4.3.1	Standard Data Management Project	28
4.3.2	Climate Change and Vulnerability Assessments	31
4.3.3	Watershed and Terrestrial Condition Assessments	32
4.3.4	Fire Behavior and Modeling	33
4.3.5	Draft Handbook and Technical Guides Review	33

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

5.0 Framework and Scope	36
5.1 Technical Guide Revision Scope.....	36
5.2 Policy Issues Beyond the Scope of this Effort	37
5.2.1 Vegetation Classification and Mapping Standards	37
5.2.2 Inventory Program Information Gaps	37
References.....	38
<u>Appendix A</u> – Business Requirements Analysis Process	39
<u>Appendix B</u> – Information Management Concepts	45
<u>Appendix C</u> – Authors and Contributors	48

1.0 Introduction

Vegetation is the primary natural resource that the Forest Service manages within the National Forests and Grasslands, and is the main resource that many State, Tribal and private entities manage in forests and grasslands. The Forest Service is responsible for managing vegetation for a variety of uses while maintaining integrity of ecosystem components and processes on a number of operational scales. One of the fundamental informational needs is consistent and continuous data on existing vegetation. The data must be sufficiently accurate and precise to use in resource planning, analysis, and monitoring. Vegetation classification, mapping, and/or inventory processes use many data sets in conjunction with vegetation data. Data products are often tailored to the specific needs of the unit conducting the work. In addition to laws and regulations, national vegetation geospatial standards promulgated by the Federal Geographic Data Committee (FGDC) and Departmental and Agency policy have been established to ensure data products can be shared and applied for a variety of uses.

1.1 Business Requirements Analysis Process

A structured inquiry is essential for identifying and evaluating business requirements and management objectives supported by resource inventory and monitoring protocols. A structured business requirements analysis also provides a benchmark for evaluating the effects of changing requirements and priorities. Detailed review of management requirements and management questions addressed provides both transparency and the ability to reexamine requirements and their priorities over time. Appendix A provides a detailed description of the business requirements analysis process.

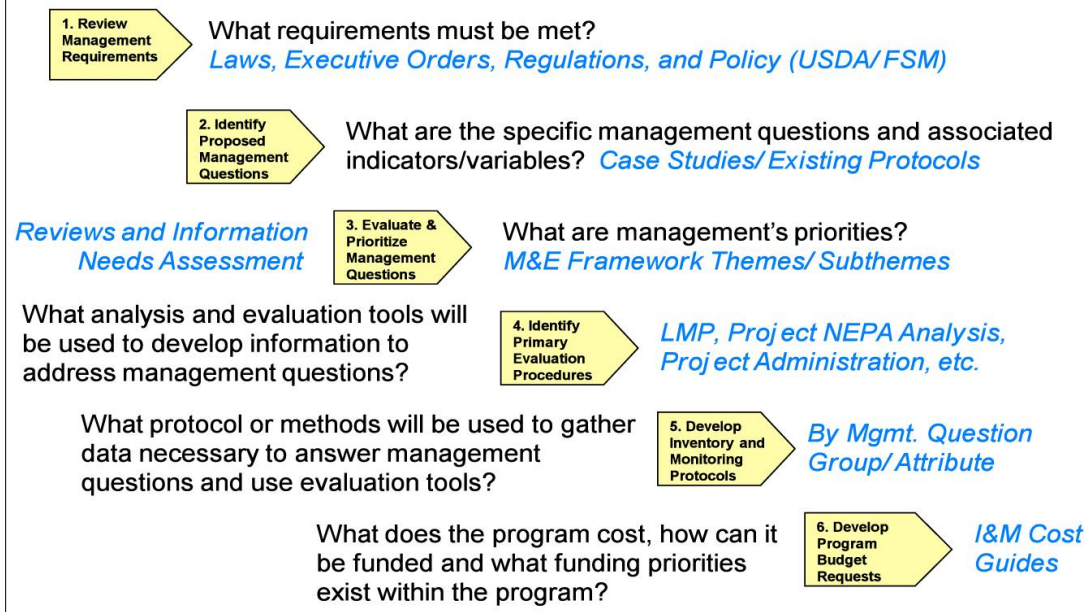
The six-step process used to develop inventory and monitoring protocols is illustrated in Figure 1. This process conforms to direction in FSM Chapter 1940 and procedures established by the USDA and Forest Service Chief Information Officers.

The initial steps of the process outlined in Figure 1 focus on identifying agency business requirements, which form the basis for the remaining development process phases. Business requirements originate from laws, regulations and policy as well as management issues and concerns.

Once business requirements are documented and understood, the next step is determining management's priorities for addressing these requirements. The next step in the process is to determine specific data variables or indicators that can be used to address management questions. Because of the variability in management question across the NFS, it is essential to develop protocol components that allow local units to mix and match inventory and monitoring methods to meet their local business needs. Once management priorities are determined and data attributes (indicators/variables) defined, it is important to consider how the data will be evaluated using standard analysis tools or models. This step is necessary to ensure data collected can be analyzed using standard tools and models. The next step is to determine if there are existing, published protocols for collecting the data that can be tested to see if they meet management needs. If not methods to collect data will need to be developed and tested. The results of the testing and evaluation will assist in determining skill and training needs and general cost estimation guides for implementation.

Figure 1 – Inventory and Monitoring Technical Guide Development Process

Based upon FSM 1940 requirements



To facilitate developing program and project budgets, the final step of development involves creating cost guides. The purpose of cost guides is to assist local NFS units in developing realistic budgets requests and estimates for costs associated with proponent-generated activities affecting NFS vegetation.

1.2 Business Case

Ecosystem assessment and land management planning at national and regional scales require consistent standards for classifying and mapping existing vegetation. This project will meet the need for consistent standards by updating the **Existing Vegetation Classification and Mapping Technical Guide** (Brohman and Bryant, 2005), and adding a chapter on integrating vegetation inventories into classifications and mapping procedures. This Technical Guide update also supports monitoring vegetation conditions.

The departure between existing and desired vegetation composition, structure and distribution is a fundamental consideration in developing vegetation management programs and designing treatment options. The Agency's position is greatly enhanced if information on existing vegetation is developed using scientifically sound procedures and is compliant with FGDC standards.

Many current and emerging issues such as climate change and implementation of the Cohesive Wildland Fire Management Strategy demand information at broad scales and extents across all vegetation types and management jurisdictions. Regional units need highly professional, quality-assured data handled following well-documented national and regional protocols. These data inform staff and decision-makers who write and approve Forest Plans and who advise regulators on the adverse effects of water development, mining, off-road vehicles, and other activities on National Forest System lands. Incomplete, missing, or out-of-date business rules and sampling protocols related to existing vegetation affect the Agency's ability to effectively collect and apply essential corporate resource information.

This effort will focus on three primary activities:

Classification – The characterization of a vegetation community using a classification system helps us understand its ecology, placement and function. Classification systems have evolved to support a variety of business needs and are used to interpret basic field data consistently between locations and jurisdictions. Because management questions span jurisdictional boundaries, the ability to organize data and conduct analyses across administrative boundaries is a consideration. One of the principal tools used to compare vegetation data across the landscape is the vegetation classification system (FGDC National Vegetation Classification Standard).

Mapping - Vegetation maps delineate the geographic distribution, extent, and landscape patterns of vegetation types and/or structural characteristics in an area of interest. Consistent mapping of vegetation needs to be based on appropriate classification systems consistent with the objectives of the map. Similar to classifications, maps often respond to management questions that span jurisdictional boundaries and need to contain the attributes and resolution needed to address the management questions. In addition, maps often form the analytical basis for spatially depicting inventory information.

Inventory – Vegetation inventories quantify the amount, composition, and condition of vegetation, and the reliability of any estimates. To be most useful, inventories need to incorporate a statistically valid sample design, be non-biased, and provide both population estimates and an indication of their reliability. Currently, there are few national guidelines for using existing vegetation inventories to assist with classification and mapping procedures.

Since many issues affecting vegetation span administrative units and involve multiple jurisdictions, effective management programs will require a landscape-level assessment and coordinated management approach to be effective. The updated Technical Guide will provide managers tools to conduct classification, mapping and inventory at multiple scales across landscapes.

As science and technology change our ability to map and inventory vegetation resources, an established change management process provides for incorporating innovations into nationally supported methods.

1.3 Summary

This document describes the procedures used to identify agency business requirements related to existing vegetation information and defines the scope of the revision effort. The document is organized into the following sections:

- | | |
|-----------|---|
| Section 2 | Identifies management requirements established by law, regulation and policy. |
| Section 3 | Discusses relationships between decision-making scales and data needs. |
| Section 4 | Provides an overview of management questions originating from a) Forest Service program priorities, b) analysis and evaluation methods, and c) review and evaluation of the application of current guidance on classification, mapping and inventory. |

- Section 5 Defines the framework and scope for the Technical Guide revision and major issues not addressed.

Additional information and detail are provided in appendices:

- Appendix A Describes the business requirements analysis process used.
- Appendix B Contains an overview of resource information management concepts.
- Appendix C Identifies the authors and contributors to this effort.

2.0 Management Requirements

Within the Forest Service, legal requirements and management issues are highly variable. However, the legal and regulatory framework described in this section applies to all NFS lands. Forest Service management requirements are grouped into three sections:

- A. Vegetation Resource Management
- B. Planning and Environmental Compliance
- C. Resource Information Management

These groups will be used to identify business requirements originating from laws, regulations and policy. The following section identifies key management requirements associated with existing vegetation classification, mapping and inventory. This information was gleaned from the Forest Service Directives System. The “Zero Code” of Forest Service Manual Chapters 2020, 2030, 2060, 2070, 2080, 2200, 2300, 2400, 2500, 2600, 3400 and 3500 were the primary sources consulted. The information summarized below is intended to focus on the principal management requirements applicable to existing vegetation classification, mapping and inventory. It is not intended to be an exhaustive or comprehensive listing of all management requirements.

2.1 *Vegetation Resource Management*

Vegetation management relies on the ability to categorize and describe discreet vegetation communities and locate them across the landscape. The varied suite of management requirements related to vegetation resource management signifies the complexity and importance. Protection, conservation, restoration and response of vegetation communities are keys to nearly every management decision on NFS lands.

Management of vegetation on NFS lands, as well as programs supporting vegetation management on industrial and private forests and grasslands in the United States, are complex and subject to various Federal statutes and policy requirements. In some instances State and Tribal regulations for protection of soil and water quality apply to National Forest System vegetation management practices. Because of this variability no attempt was made to address information needs stemming from these requirements. Readers are encouraged to consult the appropriate FSM Chapter, Regional, Station, or Area supplements to the FSM to review these requirements.

2.1.1 Statutes

Major statutory authorities that direct the overall use and management of vegetation include:

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Organic Administration Act of 1897 (at 16 U.S.C. 475, 551). States the purpose of the national forests, and directs their control and administration to be in accord with such purpose, that is, “[n]o national forest shall be established, except to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States.”

Weeks Law of 1911, as amended (at 16 U.S.C. 515, 552). Authorizes the Secretary of Agriculture to enter into agreements with States for the purpose of conserving forests and water supply, and, to acquire forested, cutover, or denuded lands within the watersheds of navigable streams to protect the flow of these streams or for the production of timber, with the consent of the State in which the land lies.

Anderson-Mansfield Reforestation and Revegetation Joint Resolution Act of 1949 (at 16 U.S.C. 581j and 581j (note)). States the policy of the Congress to accelerate and provide a continuing basis for the needed reforestation and revegetation of national forest lands and other lands under Forest Service administration or control, for the purpose of obtaining stated benefits (timber, forage, watershed protection, and benefits to local communities) from the national forests.

Sikes Act (Fish and Wildlife Conservation) of September 15, 1960 (16 U.S.C. at 670g). Section 201 directs the Secretary of Agriculture, in cooperation with State agencies, to plan, develop, maintain, coordinate, and implement programs for the conservation and rehabilitation of wildlife, fish and game species, including specific habitat improvement projects, and shall implement such projects on public land under their jurisdiction.

Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528-531). States that the National Forests are to be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes, and that establishment and maintenance of wilderness areas are consistent with this Act. This Act directs the Secretary to manage these resources in the combination that will best meet the needs of the American people; providing for periodic adjustments in use to conform to changing needs and conditions; and harmonious and coordinated management of the resources without impairment of the productivity of the land. Sustained yield means achieving and maintaining in perpetuity a high-level annual or regular periodic output of renewable resources without impairment of the productivity of the land.

Wild and Scenic Rivers Act (82 Stat. 906, as amended; 16 U.S.C. 1271 (note), 1271-1287). Establishes the National Wild and Scenic Rivers System, and policy for managing designated rivers and designating additions to the system. The Act prescribes for designated rivers and their immediate environments the protection and enhancement of their free-flowing character, water quality, and outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. Examples of management actions may include moving toward a desired range of structural vegetative conditions, increasing the amount of large in-stream wood, and improving water quality.

Endangered Species Act of 1973 (P.L. 93-205, 87 Stat. 884; 16 U.S.C. 1531-1544, as amended). States its purposes are to provide a means of conserving the ecosystems upon which endangered species and threatened species depend, and to provide a program for the conservation of such species. Federal agencies are to formulate and implement programs and activities to conserve threatened and endangered species and the ecosystems upon which they depend. Under the Act, conserve means use methods and procedures necessary to bring any endangered or threatened species to the point at which the measures provided under the Endangered Species Act are no longer necessary.

Tribal Forest Protection Act of 2004 (P.L. 108-278, 118 Stat. 868; 25 U.S.C. 3115a). Authorizes the Secretary of Agriculture and the Secretary of the Interior to enter into an agreement or contract with Indian tribes meeting certain criteria to carry out projects to protect Indian forest land or rangeland, including a project to restore Federal land that borders on or is adjacent to Indian forest land or rangeland.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

The Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (16 U.S.C. 1600-1612) (as amended by National Forest Management Act (NFMA) of 1976 (16 U.S.C. 472a)). States that the development and administration of the renewable resources of the National Forest System are to be in full accord with the concepts for multiple use and sustained yield of products and services as set forth in the Multiple-Use Sustained-Yield Act of 1960. The RPA of 1974 sets forth the requirements for land and resource management plans for units of the National Forest System, including requiring guidelines to provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area.

Bankhead-Jones Farm Tenant Act of 1937 (7 U.S.C. §§1010 *et seq.*). Title III authorizes the Secretary to develop a program of land conservation and land utilization in order to correct maladjustments in land use. Applies only to national grasslands and land utilization projects.

Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201, 1201 (note), 1236, 1272, 1305). Section 515 directs establishing on the mined areas, and all other lands affected, a diverse, effective and permanent vegetative cover of the same seasonal variety native to the area of land to be affected and capable of self-regeneration and plant succession at least equal in extent of cover to the natural vegetation on the area; except that introduced species may be used in the revegetation process where desirable and necessary to achieve the approved post mining land use plan.

The North American Wetland Conservation Act 1989 (16 U.S.C. 4401 (note), 4401-4413, 16 U.S.C. 669b (note)). Section 9 (U.S.C. 4408) Directs Federal agencies to cooperate with the Director of the U.S. Fish and Wildlife Service to restore, protect, and enhance the wetland ecosystems and other habitats for migratory birds, fish and wildlife within the lands and waters of each agency to the extent consistent with the mission of such agency and existing statutory authorities.

The Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 *et seq.*). Requires cooperation with State, local, and other Federal agencies in the application and enforcement of all laws and regulations relating to management and control of noxious weeds. The Federal Noxious Weed Act directs the Secretary of Agriculture to: develop and coordinate a management program for control of undesirable plants which are noxious, harmful, injurious, poisonous, or toxic on Federal lands under the agency's jurisdiction, complete and implement cooperative agreements and/or memorandums of understanding regarding the management of noxious weeds on Federal lands under the agency's jurisdiction, and establish Integrated Weed Management to control or contain species identified and targeted under cooperative agreements and/or memorandums.

Granger-Thye Act of April 24, 1950, Sections 1, 5, 7, 11, 12, 18, 19, (Ch. 97, 64 Stat. 82; 16 U.S.C. 571c; 16 U.S.C. 572; 16 U.S.C. 580d; 16 U.S.C. 580g; 580h; 16 U.S.C. 580k; 16 U.S.C. 580).

Wilderness Act of September 3, 1964, Section 4 (P.L. 88-577, 78 Stat. 890; 16 U.S.C. 1133).

Wild Horses and Burros Protection Act of December 15, 1971 (P.L. 92-195, 85 Stat. 649, as amended; 16 U.S.C. 1331-1340).

Federal Land Policy and Management Act of October 21, 1976, Sections 206, 310, 401, 402, 403, 404, (P.L. 94-579, 90 Stat. 2743, as amended; 43 U.S.C. 1716; 43 U.S.C. 1740; 43 U.S.C. 1751; 43 U.S.C. 1752; 43 U.S.C. 1753).

Public Rangelands Improvement Act of October 25, 1978 (92 Stat. 1803, 43 U.S.C. 1752-1753, 1901-1908).

Clarke-McNary Act of June 7, 1924, as Amended. (43 Stat. 653). This act authorizes the Secretary of Agriculture to determine the location of public lands that are chiefly valuable for streamflow protection and that can be economically administered as parts of National Forests.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Watershed Protection and Flood Prevention Act of August 4, 1954, as Amended. (68 Stat. 666; Pub.L. 83-566; 16 U.S.C. 1001). This act authorizes the Secretary of Agriculture to cooperate with the States and their political subdivisions and local public agencies in preventing watershed damages from erosion, floodwater, and sediment, and in furthering the conservation, development, utilization, and disposal of water. The act also authorizes the Secretary to cooperate with other Federal, State, and local agencies in making investigations and surveys of the watersheds of rivers and other waterways as a basis for planning and developing coordinated programs, and to pursue additional works of improvement on the 11 watersheds authorized by the Flood Control Act of December 22, 1944, as amended.

Joint Surveys of Watershed Areas Act of September 5, 1962. (Pub.L. 87-639; 76 Stat. 438). This act authorizes the Secretary of the Army and the Secretary of Agriculture to conduct joint investigations and surveys of watersheds for flood prevention or the conservation, development, utilization, and disposal of water and for flood control and allied purposes; to prepare joint reports on such investigation and surveys for submission to the Congress; and for other purposes, provided these do not affect compliance with Pub.L. 83-566.

Clean Water Restoration Act of 1966. (80 Stat. 1246.) This act provides for development of cooperative water quality control and abatement plans under the leadership of the Secretary of the Interior. This is an amendment to the Federal Water Pollution Control Act.

Cooperative Forestry Assistance Act of 1978 (92 Stat. 356; 16 U.S.C. 2101 (note) as amended). Section 8 of this act sets forth the basic Federal authority for forest insect and disease management and assigns the primary Federal authority for insect and disease control to the Secretary of Agriculture. The act provides for Federal, State, and private cooperation in managing for forest insects and diseases and the need for Federal leadership and financial assistance on all forest lands. The act does not give Federal agencies the right of entry on non-Federal lands, because such authority is regulated by States.

Forest Ecosystems and Atmospheric Pollution Research Act of 1988 (P.L. 100-521, 102 Stat 2601; 16 U.S.C. 1642). This act directs the Secretary of Agriculture to conduct such surveys as are necessary to monitor the long-term trends in the health and productivity of domestic forest ecosystems.

Hawaii Tropical Forestry Recovery Act of 1992 (106 Stat. 4593, 16 U.S.C. 4502a, 4503 et seq.). This act grants authorities to the Secretary of Agriculture to treat invasive plants on Federal and non-Federal ownerships in Hawaii and in tropical forests on Federal lands in other States.

Healthy Forest Restoration Act of 2003 (117 Stat. 1887, 16 U.S.C. 6501). This act improves the capacities of the Secretaries of Agriculture and Interior to conduct hazardous fuels reduction projects on National Forest System and Bureau of Land Management lands in order to protect communities, watersheds, and other at-risk lands from catastrophic wildfire. Title I requires the Secretary of Agriculture to conduct fuels reduction projects on Federal land on which “windthrow or blowdown, ice storm damage, the existence of an epidemic of disease or insects or the presence of such an epidemic on immediately adjacent land and the imminent risk it will spread poses a significant threat to an ecosystem component or forest” to use an expedited environmental analysis and appeal process. Title VI requires the Secretary of Agriculture and the Department of the Interior working through the Forest Service and the U.S. Geological Survey, as appropriate, 1) to plan, conduct, and promote comprehensive and systematic information gathering on forest-damaging insects and associated diseases, 2) assist land managers in developing treatments and strategies to improve forest health and reduce susceptibility of forest ecosystems to insects and diseases, 3) disseminate results of the information gathering, and 4) cooperate with colleges, universities, Federal, State, and local agencies, and private and industrial partners. The Title also provides that the Secretary may conduct silvicultural assessments on Federal lands at risk of infestation by, or infested with, forest-damaging insects.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Small watershed programs under the Watershed Protection and Flood Prevention Act (P.L. 83-566) of 1954 (68 Stat. 666 as amended; 16 U.S.C. 1001-1008, 33 U.S.C. 701b (note)).

Emergency watershed protection projects under section 403 of the Agriculture Credit Act of 1978 (P.L. 95-334, Stat. 434; 16 U.S.C. 2203).

The following authorities provide a basis for Forest Service cooperation with the Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), National Park Service (NPS), and U.S. Fish and Wildlife Service (FWS) agencies of the Department of Interior (DOI) on all aspects of wildland fire management and as authorized in non-fire emergencies. Effective coordination requires consistent vegetation information across administrative units and non-federal lands.

McSweeney-McNary Act, 1928 (45 Stat. 221; 16 U.S.C. 487). This act authorizes the Secretary of Agriculture to establish forest and rangeland research facilities and to provide competitive grants to public and private institutions, to agencies and to individuals to further such research activities. The act directs the Secretary to maintain a comprehensive survey and analysis of the present and prospective conditions of and requirements for the renewable resources of the forests and rangelands of the United States and of the supplies of such renewable resources.

National Indian Forest Resources Management Act, November 28, 1990 (Presidential Order 101-630). This act requires the Secretary of the Interior to undertake management activities on Indian forest lands, in furtherance of the U.S. trust responsibility for these lands. These activities must incorporate the principles of sustained yield and multiple use and include tribal participation.

Tribal Forest Protection Act, 2004 (P.L. 108). This act authorizes the Secretary of the Interior (with respect to land under the jurisdiction of the Bureau of Land Management) or the Secretary of Agriculture (with respect to land under the jurisdiction of the Forest Service) to carry out a project to protect Indian forest land or rangeland (including a project to restore Federal land that borders on or is adjacent to such land) under the Secretary's jurisdiction and bordering or adjacent to the Indian forest land or rangeland under the Indian tribe's jurisdiction.

2.1.2 Regulations, Executive Orders and Departmental Policy

Additional requirements for vegetation management are established by the following Executive Orders:

Executive Order 11514 issued March 5, 1970, as amended by E.O. 11991 issued May 24, 1977. Protection and enhancement of environmental quality (35 FR 4247, March 7, 1970). This order states that the Federal Government shall provide leadership in protecting and enhancing the quality of the nation's environment to sustain and enrich human life. This order provides for monitoring, evaluation, and control on a continuing basis of the activities of each Federal agency so as to protect and enhance the quality of the environment.

Executive Order 11988 issued May 24, 1977. Floodplain management (42 FR 26951, May 25, 1977). This order requires that each agency shall provide leadership and take action to:

- Minimize adverse impacts associated with the occupancy and modification of flood plains and reduce risks of flood loss;
- Minimize impact of floods on human safety, health, and welfare, and;
- Restore and preserve the natural and beneficial values served by floodplains.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Executive Order 11990 issued May 24, 1977. Protection of wetlands. (42 FR 26961, May 25, 1977). This order requires each agency to take action to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

Executive Order 13112 issued February 3, 1999. Invasive Species. (64 FR 6183, February 8, 1999). This order requires federal agencies whose actions may affect the status of invasive species to, among other things, respond to and control populations of invasive species and provide for restoration of native species and habitat conditions in ecosystems that have been invaded by non-native invasive species.

Executive Order 13112. Invasive Species 64 Fed. Reg. 6183 (February 8, 1999). Provides for restoration of native species and habitat conditions in ecosystems that have been invaded by non-native invasive species.

Executive Order 13112 issued February 3, 1999 (E.O. 13112). Directs Federal agencies to identify actions that may affect the status of an invasive species, prevent introduction of such species; detect and control such species, monitor population of such species, provide for restoration of native species, conduct research on invasive species and develop technologies to prevent introduction of such species, promote public education about such species, and not authorize, fund, or carry out actions likely to cause the introduction or spread of invasive species in the United States or elsewhere unless the benefits of the action clearly outweigh the harm and that steps to minimize the harm will be taken.

The Secretary of Agriculture sets forth responsibilities mandated by statutory authority through Departmental regulations and memoranda. Policy relating to range resources and coordination of range activities of USDA agencies and other executive agencies, organizations, and individuals is included in the following:

Departmental Regulation 9500-10 (DR 9500-10) sets forth Departmental policy for the management and coordination of noxious weed activities among agencies of the Department of Agriculture and other executive agencies, organizations, and individuals. DR 9500-10 specifically establishes Integrated Pest Management (FSM 2080.5) as the preferred approach to noxious weed prevention, control, and eradication.

Secretary's Administrative Order of August 1963, Administration of Lands Under Title III of the Bankhead-Jones Farm Tenant Act; Establishment of National Grasslands.

Departmental Regulation, Number 9500-5, dated December 15, 1983; Subject: Policy on Range.

Departmental Regulation 9500-4. USDA policy on wildlife, fish, and plant habitat management pertinent to public lands.

Regulations governing the management of NFS lands and other lands under Forest Service administration are found in the Code of Federal Regulations under Title 36, Chapter II, Parts 200-299, to implement the statutory requirement (16 U.S.C. 1604(g)(3)(B)) to provide for diversity of plant and animal communities.

Range Program Regulations conferring authority to the Chief of the Forest Service include:

- Grazing and Livestock Use on the National Forest System, 36 CFR Part 222, Subpart A.
- Management of Wild Free-Roaming Horses and Burros, 36 CFR Part 222, Subpart B.
- Administration of Lands Under Title III of the Bankhead-Jones Farm Tenant Act by the Forest Service, 36 CFR 213.
- Wilderness-Primitive Areas, 36 CFR 292.7.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Noxious Weed Management Regulations at 36 CFR 222.8 acknowledge the Agency's obligation to work cooperatively in identifying noxious weed problems and developing control programs in areas where National Forest System lands are located.

2.2 Planning and Environmental Compliance

Policy and procedures for land management planning and environmental compliance activities are outlined in FSM Chapters 1920 and 1950 respectively. Requirements vary according to the planning regulations that were in effect at the time the land and resource management plan was issued for a NFS administrative unit.

In general, most existing land and resource management plans within the NFS are consistent with the requirements of 36 CFR 219 promulgated in 1982. In these instances a two-staged decision process is used to comply with various statutes and regulations in the planning process. Land and resource management plan decisions identify where activities are excluded and provide standards and guidelines for activities and projects within certain areas. Project and activity decisions must either be consistent with the plan's requirements or propose an amendment to the plan.

Plans issued using the 2008 version of 36 CFR 219 provide a framework of plan components and desired condition descriptions. The regulations provide a different approach to meeting the requirements of the National Forest Management Act. In general, project and activity environmental compliance utilize plan components, including desired conditions and design standards to develop proposed actions, consider environmental consequences and decide on a course of action.

2.2.1 Statutes

The following laws set forth the requirements for Forest Service planning and environmental compliance:

The National Environmental Policy Act (NEPA) of 1969 (16 U.S.C. 4321 et seq.). This act sets forth requirements to consider the environmental impact of proposed actions, identify adverse environmental effects which cannot be avoided, consider alternatives to the proposed action, consider the relationship between local short-term uses and long-term productivity, and identify any irreversible and irretrievable commitments of resources (FSM 1950).

The Forest and Rangelands Renewable Resources Planning Act (RPA) of 1974 (16 U.S.C. 1601 et seq.). This act directs the Secretary of Agriculture to periodically assess the national situation of forest and rangeland resources. This assessment is called the Forest and Rangelands Renewable Resources Planning Act (RPA) assessment. See FSM 1906 and FSM 1910 for detailed requirements.

The National Forest Management Act (NFMA) of 1976 (16 U.S.C. 1600 et seq.). This act amends the Renewable Resource Planning Act (RPA) and sets forth the requirements for plans (for the National Forest System). See FSM 1920 for specific requirements.

Forest and Rangeland Renewable Resources Research Act of 1978 (16 U.S.C. 1641 et seq.). This act directs the Secretary of Agriculture to include, as appropriate, research activities when managing forest and rangeland resources.

Cooperative Forestry Assistance Act of 1978 (16 U.S.C. 2101 et seq.). This act provides authority for financial, technical, and related assistance to states for forest resource planning.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Agriculture and Food Act of 1981 (7 U.S.C. 4201 et seq.; 16 U.S.C. 590, 3401 et seq.). Title XVI of this act requires joint planning of forestry research among the Forest Service Cooperative State Research, Education, and Extension Service and the Nation's 61 forestry schools.

The Government Performance and Results Act (GPRA) of 1993 (5 U.S.C. 306). This act provides for the development of agency long-term strategic plans, annual performance plans, and annual performance reports. The Forest Service Strategic Plan (Strategic Plan) provides the national framework for all agency operations and activities. The Strategic Plan uses information from the periodic assessment of the Nation's forest and range resources under the Renewable Resource Planning Act (RPA).

Endangered Species Act of 1973 (ESA). (P.L. 93-205, 87 Stat. 884, as amended; 16 U.S.C. 1531-1536, 1538-1540). This act charges Federal agencies to utilize their authorities to carry out programs and activities for the conservation of endangered and threatened species and the ecosystems upon which they depend, and ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any species endangered, threatened or proposed for listing as endangered or threatened, or result in the destruction or adverse modification of designated critical habitat.

2.2.2 Regulations, Executive Orders and Departmental Policy

Requirements for planning and environmental compliance are established by the Secretary of Agriculture in the following regulations:

Title 36, Code of Federal Regulations, Part 219, Subpart A. This regulation provides direction on land management planning procedures on National Forest System lands.

Title 40, Code of Federal Regulations, Sections 1500 through 1508.28. This regulation directs the Forest Service to apply environmental analysis to environmentally significant decision points during National Environmental Policy Act (NEPA) activities.

2.3 Resource Information Management

Requirements related to resource information management are extensive and apply to a wide variety of agency procedures and management functions. The Department of Agriculture and Forest Service Chief Information Officers (CIO) have established policy and provide continuing oversight of agency activities in this arena. Key resource information management concepts used in this business requirements analysis are summarized in Appendix B.

Forest Service Natural Resource Manager applications (NRM) comply with the CIO's requirements. Conformance with agency resource information management requirements will be achieved using existing data definitions, classification systems, information security provisions, and NRM applications whenever possible.

Compliance with procedures established by the Forest Service CIO and FSM Chapter 1940 satisfies the provisions of the Data Quality Act and USDA implementing regulations.

2.3.1 Statutes

Major statutory authorities that direct the overall management of resource information include:

Paperwork Reduction Act of 1980, as amended by the Paperwork Reduction Act of 1995 (44 USC 35). Directs Federal agencies to perform information resources management activities in an efficient,

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

effective, and economical manner; to follow uniform and consistent information resources management policies; to apply information management principles, standards, and guidelines; to evaluate information resources management practices according to adequacy and efficiency; and to comply with policies, principles, standards, and guidelines promulgated by the Office of Management and Budget.

Federal Managers Financial Integrity Act of 1982 (31 USC 3512). Directs Federal agencies to design management structures to help ensure accountability for results and include appropriate cost-effective controls.

Government Performance and Results Act of 1993 (GPRA, P.L. 103-62). Establishes for Federal agencies the goal of integrating budget and performance by directing those agencies to establish performance plans containing indicators upon which measurement of success will occur; to ensure, to the extent practicable, information relevancy, accuracy, and timeliness; and to assess program performance primarily according to outcome goals, rather than output goals, including outcome goals associated with cost, understandable dissemination, and mission achievement.

Clinger-Cohen Act of 1996 (P.L. 104-106). Establishes that Federal agencies will manage information technology and information resources by using sound management principles, including project planning, and will improve the efficiency and effectiveness of agency operations and the delivery of agency services through effective use of information technology.

Information Quality Act of 2001 (Data Quality Act, P.L. 100-554, section 515). Directs Federal agencies to ensure and maximize the quality, objectivity, utility, and integrity of information disseminated including statistical information, to ensure the information is useful, clear, and sound.

Major authorities specific to coordination and collaboration associated with resource inventory, monitoring, and assessments include:

Cooperative Funds Act of June 30, 1914 (16 USC 498 as amended by Public Law 104-127). This Act authorizes the Forest Service to accept money received as contributions toward cooperative work in forest investigations or protection, management, and improvement of the National Forest System (FSM 1584.11).

Granger-Thye Act of April 24, 1950 (16 USC 572). Section five of this Act authorizes the Forest Service to perform work to be done for the benefit of the depositor, for administration, protection, improvement, reforestation, and such other kinds of work as the Forest Service is authorized to do on lands of the United States: (a) on State, county, municipal, or private land within or near national forest land, or (b) for others who occupy or use national forests or other lands administered by the Forest Service.

Sikes Act of September 1, 1960 (16 USC 670g-6701, 670o, Public Law 86-797, as amended). This Act authorizes the Forest Service to cooperate with State wildlife agencies in conservation and rehabilitation programs for fish, wildlife, and plants considered threatened or endangered.

Intergovernmental Cooperation Act of 1968, as amended by the Intergovernmental Cooperation Act of September 13, 1982 (31 USC 6501-6508, Public Law 97-258). Title III of this Act authorizes the Forest Service to provide special or technical services to States or subdivisions of States.

Federal Advisory Committee Act (FACA) of 1972, as amended (5 U.S.C. Appendix 2). This Act regulates the establishment, use, and reporting of advisory committees.

Cooperative Funds and Deposits Act of December 12, 1975 (16 USC 565a1-a3, Public Law 94-148). This Act authorizes the Forest Service and partners to perform work from which they would accrue mutual non-monetary benefit.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Cooperative Forestry Assistance Act of 1978, as amended (16 USC 2101-2114, Public Law 95-313). This Act authorizes the Forest Service to work through and in cooperation with state foresters or equivalent agencies, and other countries in implementing technical programs affecting non-federal forest lands.

1990 Farm Bill (PL 101-624). This Bill authorizes Federal financial assistance for forest pest prevention and suppression on forested lands in all ownerships for the purposes of promoting healthy sustainable forests, forest stewardship, and sustainable economic development.

Interior and Related Agencies Appropriations Act of 1992 (Public Law 102-154, (Challenge Cost Share)). This Act authorizes the Forest Service to cooperate with others in developing, planning, and implementing mutually beneficial projects that enhance Forest Service activities, where the partners provide matching funds or in-kind contributions. Partners may be public or private agencies, organizations, institutions, or individuals (FSM 1587.12). The Act also gives the agency the authority to provide non-monetary awards and to incur necessary expenses for the non-monetary recognition of individuals and organizations (FSM 6511.13e).

The Freedom of Information Act of 1966 (5 U.S.C. 552) as amended 1996 (P.L. 104-231, 1105 at 3048). This Act requires agencies of the Federal Government to make certain agency information available for public inspection and copying, and to establish access to the records of such agencies, subject to statutory exemptions, for any public or private purpose.

Secure Rural Schools and Community Self-Determination Act of 2000 (Public Law 106-393; also called "Payments to States"). This Act establishes resource advisory committees as a mechanism for local community collaboration on certain types of projects.

Stewardship Contracting, Revised 2003 (P.L. 108-7, 16 U.S.C. 2104 Note). This Act provides the Forest Service and the Bureau of Land Management ten-year authority to enter into stewardship contracts and agreements to promote collaborative working relationships with local communities, improve land conditions, and help develop sustainable rural economies.

Title 41, Code of Federal Regulations, Part 102-3 – Federal Advisory Committee Management Regulations (41 CFR part 102-3). This regulation defines policies, sets up minimum requirements, and provides guidance for the establishment, operation, administration, and duration of advisory committees subject to the Federal Advisory Committee Act, as amended.

Major authorities specific to resources include:

Organic Administration Act of June 4, 1897 (30 Stat. 34), as amended (16 U.S.C. 473 § § *et. seq.*). This Act authorizes the Secretary of Agriculture to establish regulations governing the occupancy and use of forests and to protect national forests from destruction. This Act contains the initial basic authority for watershed management on national forest lands. The purpose for the establishment of national forests, as stated in the Act, includes securing favorable conditions of water flows. The Act directs the completion of surveys to show distribution of the forests.

Weeks Law Act of March 1, 1911 (P.L. 61-435, Ch. 186, 36 Stat. 961), as amended. Section six of the Act authorizes the Secretary of Agriculture to examine, locate, and purchase lands within the watersheds of navigable streams necessary to the regulation of the flow of navigable streams or for the production of timber.

Mineral Leasing Act, February 25, 1920 (P.L. 66-146, 41 Stat. 437), as amended. Section 8A of this Act authorizes the Secretary to conduct a comprehensive exploratory program to obtain sufficient data and information to evaluate the extent, location, and potential for developing the known recoverable coal resources within the coal lands subject to this chapter.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

McSweeney-McNary Forest Research Act of 1928 (P.L. 70-466). This is enabling legislation for inventory, monitoring, and assessment activities in the Forest Service.

Fish and Wildlife Coordination Act of 1934 (Ch. 55, 48 Stat. 401, as amended; 16 U.S.C. 661, 662(a), 662(h), 663(c), 663(f)). This Act authorizes surveys and investigations of the wildlife of the public domain lands including lands and waters of interest therein acquired or controlled by any agency of the United States.

Federal Water Pollution Control Act of June 30, 1948 (P.L. 80-845; as amended; 33 U.S.C. 1251). This Act authorizes the conduct of investigations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of pollution.

Watershed Protection and Flood Prevention Act of August 4, 1954 (P.L. 566), as amended (68 Stat. 666, 16 U.S.C. 1001; FSM 1021.2). This Act authorizes the Secretary of Agriculture to cooperate with the States and their political subdivisions and local public agencies to conduct surveys and investigations of watersheds and rivers to prepare plans for works of improvement for watershed protection and flood prevention.

Fish and Wildlife Act, August 8, 1956 (P.L. 84-1024, Ch. 1036, 70 Stat 1119, 16. U.S.C. 742a, d, e, i and j). This Act authorizes the Secretary to conduct investigations and prepare periodic reports related to production and flow of fish to market and biological requirements of fish and wildlife resources.

Multiple-Use Sustained-Yield Act of June 12, 1960 (16 U.S.C. 528-531; FMS 1021.2). The Secretary of Agriculture is directed to develop and administer the renewable surface resources of the national forests for multiple-use and sustained-yield of the several products and services obtained there from, with due consideration to the relative values of the various resources in particular areas and without impairment of the productivity of the land.

Joint Surveys of Watershed Acres Act of September 5, 1962 (P.L. 87-639, 76 Stat. 438; 16 U.S.C. 1009). This Act authorizes the Secretaries of the Army and Agriculture to make joint investigations and surveys of watershed areas to identify works needed for flood prevention and control.

Wilderness Act of 1964 (P.L. 88-577, 78 Stat. 890; 16 U.S.C. 1121 (note), 1131-1136). Section four of the Act requires each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area. To comply requires agencies to monitor and inventory wilderness attributes to identify and evaluate how selected actions and conditions related to wilderness character are changing. Administering agencies are to monitor compliance with the wilderness responsibilities to preserve the wilderness character of an area designated as wilderness.

Federal Water Project Recreation Act of July 9, 1965. (16 U.S.C. 460). This Act provides uniform policies for investigating, planning, and constructing Federal water projects to protect and enhance where possible, recreation and fish.

Water Quality Act of 1965 (79 Stat. 903). This is an amendment to the Federal Water Pollution Control Act of July 9, 1956. It provides for the Federal Government to cooperate with State agencies or municipalities preventing or controlling pollution of waters over which they have jurisdiction (FSM 2542.3).

Wild and Scenic Rivers Act of 1968 (P.L. 90-542, U.S.C. 1271-1287) as amended 1996. This Act establishes a National Wild and Scenic Rivers System for the protection of rivers with important scenic, recreational, fish and wildlife, or other values. Rivers are classified as wild, scenic, or recreational. The Act designates specific rivers for inclusion in the system and prescribes the methods and standards by which additional rivers may be added.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Wild and Scenic Rivers Act of October 2, 1968 (P.L. 90-542) – Title 16, Conservation, Chapter 28. Section 1283). The head of any agency administering a component of the national wild and scenic rivers system shall cooperate with the Administrator, Environmental Protection Agency and appropriate State water pollution control agencies for the purpose of eliminating or diminishing the pollution of waters of the river.

National Environmental Policy Act of 1969 (NEPA) (P.L. 91-190, 83 Stat. 852; U.S.C. 4321 (Note), 4321, 4331-4335, 4341-4347). Section 102 directs that all agencies of the Federal Government shall utilize a systematic, interdisciplinary approach to insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making, which may have an impact on the human environment. See Forest Service Handbook (FSH) 1909.14-Resource Inventory Handbook, and FSH 1909.15-National Environmental Policy Act Handbook, for Council on Environmental Quality (CEQ) regulations implementing NEPA. See 40 CFR sections 1502.3 and 1505.3 for regulations on monitoring decisions.

Environmental Quality Improvement Act of April 3, 1970, as amended (P.L. 91- 224, Title II; P.L. No. 97-258, September 13, 1982; and P.L. No. 98-581, October 30, 1984. 42 USC § 4372). Section a...d(3) calls for reviewing the adequacy of existing systems for monitoring and predicting environmental changes in order to achieve effective coverage and efficient use of research facilities and other resources; and d(7) calls for collecting, collating, analyzing, and interpreting data and information on environmental quality, ecological research, and evaluation.

Water Quality Improvement Act of 1970 (84 Stat. 91). Title I requires Federal agency compliance with water quality standards.

Wild Horses and Burros Protection Act of December 15, 1971 (P.L. 92-195, as amended; 16 U.S.C. 1331-1338, 1338a, 1339, 1340). This Act directs the Secretary of Interior to maintain a current inventory of wild free-roaming horses and burros on given areas of public lands, for the purpose of making determinations as to existence of overpopulation, and to determine appropriate management levels on these areas of public lands.

Federal Water Pollution Control Act amendments of October 18, 1972 (P.L. 92-500; 86 Stat. 816; 33 U.S.C. 1251 *et. seq.*). This amendment to the Clean Water Act has a primary objective to restore and maintain the chemical, physical, and biological integrity of the Nation's waters, including water quality that is both "fishable and swimmable." Federal and State agencies are directed to develop comprehensive programs for prevention, reduction, or elimination of water pollution.

Endangered Species Act of 1973 (ESA). (P.L. 93-205, 87 Stat. 884, as amended; 16 U.S.C. 1531-1536, 1538-1540). This act charges Federal agencies to utilize their authorities to achieve the purposes of the ESA by carrying out programs and activities for the conservation of endangered and threatened species and the ecosystems upon which they depend, and ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered, threatened or proposed species, or result in the destruction or adverse modification of designated critical habitat.

Forest and Rangeland Renewable Resources Planning Act of 1974 (P.L. 93-378, 88 Stat. 476, as amended; 16 U.S.C. 1601 (Note), 1600-1614). This Act directs the Secretary of Agriculture to periodically assess the national situation of the forest and rangeland resources, and to submit to Congress, at regular intervals, recommendations for long-range Forest Service programs essential to meet future resource needs. This assessment is called the Forest and Rangelands Renewable Resources Planning Act (RPA) assessment. The law requires a comprehensive and appropriately detailed inventory of all National Forest System lands and renewable resources be maintained on a continuing basis (section five).

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Safe Drinking Water Act of December 16, 1974 (P.L. 93-523). This Act and all applicable amendments provide for safe drinking water and direct the Environmental Protection Agency (EPA) to establish national drinking water regulations. The Act directs the identification of protection areas, and the preparation of impacts on quality and quantity of groundwater, requiring inventory of source areas.

Federal Noxious Weed Act of 1974 (January 3, 1975, P.L. 93-629, as amended, 81 Stat. 2148; 7 U.S.C. 2801 (note), 2801-2814). This Act directs the management of undesirable plants on Federal lands, requiring Federal agencies to establish an undesirable plants management program. Departmental policy requires providing periodic land and aquatic resource inventories compatible among agencies to identify and classify noxious weeds and their infestations.

National Forest Management Act of 1976 (P.L. 94-588, 90 Stat. 2949, as amended; 16 U.S.C. 472a, 476, 500, 513-516, 518, 521b, 528 (Note), 576b, 594-2 (Note), 1600 (Note), 1601 (Note), 1600-1602, 1604, 1606, 1608-1614). Sections two 2, 6(f)(3), and 6(g)(2), emphasize the stipulations of the Renewable Resources Planning Act of 1974. The Act also requires that the Forest Service establish quantitative and qualitative standards and guidelines for land and resource planning and management. The Act directs the Forest Service to "insure research on and (based upon continuous monitoring and assessment in the field) evaluation of the effects of each management system...."

Federal Land Policy and Management Act of 1976 (P.L. 94-579, 90 Stat. 2743, as amended; 43 U.S.C. 1701 (Note), 1701, 1702, 1712, 1714-1717, 1719, 1732b, 1740, 1744, 1745, 1751-1753, 1761, 1763-1771, 1781, 1782; 7 U.S.C. 1212a; 16 U.S.C. 478a, 1338a). This Act requires that public lands and their resources be periodically and systematically inventoried, and that an evaluation of the current natural resource use and values be made of adjacent public and nonpublic land.

Soil and Water Conservation Act of 1977 (P.L. 95-192, 91 Stat. 1407; 16 U.S.C. 2001-2009). This Act authorizes the Secretary of Agriculture to obtain and maintain information of the current status of soil, water, and related resources. The Act further requires an integrated system capable of using combinations of resource data to determine the quality and capabilities for alternative uses of the resource base and to identify areas of local, State, and national concerns.

Clean Water Act of 1977 (December 27, 1977, 91 Stat. 1566, P.L. 95-217) and the 1977 amendments, December 1977, NO. 95-12. Title 33 Navigation and Navigable Waters, Chapter 26 Water Pollution Prevention and Control. Section 1256 prohibits grants to States without established water quality monitoring procedures. Section 1271 directs the Administrator and Secretary to conduct a program of monitoring and assessing aquatic sediment quality, and to identify and assess sources, extent and effect of aquatic sediment pollutants. Section 1288 directs the development of Best Management Practices programs.

Forest and Rangeland Renewable Resources Research Act of 1978 (P.L. 95-307, 92 Stat. 353, as amended; 16 U.S.C. 1600 (Note), 1641-1647). This Act directs the Secretary of Agriculture to make and keep current a comprehensive survey and analysis of the conditions and requirements of the forests and rangelands of the United States.

Public Rangelands Improvement Act of 1978 (P.L. 95-514, 92 Stat. 1806; 43 U.S.C. 1752-1753, 1901-1908; 16 U.S.C. 1333(b)). Section four directs the Secretary of Agriculture to maintain a current inventory of range conditions and trends of rangeland conditions on the public rangelands.

Fish and Wildlife Conservation Act of September 29, 1980 (P.L. 96-366, 96 Stat. 1322, 16 U.S.C. 2901 (note), 2901-2904; 16 U.S.C. 2905-2911). This Act encourages States to develop a plan for the conservation of fish and wildlife, particularly those species indigenous to the State. The Act recommends these plans provide for an inventory of the nongame fish and wildlife and provide for the monitoring, on a regular basis, of the plan species and the effectiveness of conservation actions.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Forest Ecosystems and Atmospheric Pollution Research Act of 1988 (P.L. 100-521, 102 Stat 2601; 16 U.S.C. 1642 (Note)). Section three directs the Forest Service to increase the frequency of forest inventories in matters that relate to atmospheric pollution and conduct such surveys as are necessary to monitor long-term trends in the health and productivity of domestic forest ecosystems. This is also enabling legislation for the Forest Health Monitoring (FHM) program.

Healthy Forest Restoration Act of 2003 (117 Stat 1887, 16 U.S.C. 6501 (note)). Title VI requires the Secretary of Agriculture to establish an “early warning system” for potential catastrophic threats to forests (including insect, disease, invasive species, fire, weather-related risks, and other episodic events) to isolate and treat a threat before it gets out of control.

2.3.2 Executive Orders, Regulations and Departmental Policy

Additional information management requirements are established in Executive Orders and Homeland Security Presidential Directives.

Executive Order 11991, (May 24, 1977) (Amended Executive Order 11514 of March 5, 1970). Directs Federal agencies to monitor, evaluate, and control, on a continuing basis, their agencies’ activities so as to protect and enhance the quality of the environment.

Executive Order 11990 (May 24, 1977), (42 FR 26961, 3 CFR, 1977). Requires each agency to take action to minimize destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

Executive Order 12962, June 7, 1995. Establishes the National Recreational Fisheries Coordination Council and directs the Council to develop a Recreational Fishery Resources Conservation Plan. This plan details actions to be taken by identified Federal agencies and includes a method of ensuring agency accountability and comprehensive mechanism to evaluate achievements. The plan will, to the extent practicable, be integrated with existing plans and programs, reduce duplication, and will include recommended actions for cooperation with States, Tribes, conservation groups, and the recreational fisheries community.

Executive Order 12906 – Coordinating Data Acquisition and Access (59 FR 71, p. 17671, April 13, 1994) as amended by Executive Order 13286 (68 Fed Reg 43, p. 10619, March 5, 2003): Directs Federal agencies to document in a standardized manner all new geospatial data collected or produced. Directs the Federal Geographic Data Committee (FGDC) to establish documentation standards for geospatial data, and directs Federal agencies to provide public access to geospatial data, to the extent permitted by law and current policies, according to procedures established in conjunction with the FGDC. The FGDC was established by the Office of Management and Budget (OMB) Revised Circular A-16. Its mission is to “promote the coordinated development, use, sharing, and dissemination of surveying, mapping, and related spatial data.” 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”.

Homeland Security Presidential Directive (HSPD) 7. Requires certain Federal agencies to identify and prioritize critical national infrastructure and resources for protection from terrorist acts that could cause catastrophic health impacts or mass casualties; undermine public confidence; or disrupt essential government functions, essential services, or the economy. HSPD-7 designates EPA as the Sector-Specific Agency for the Water Sector.

Information management requirements are also established by regulations promulgated by the Secretary of Agriculture:

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Title 36, Code of Federal Regulations, Section 200. Describes the agency functions towards which inventory, monitoring, and assessment activities are directed.

Title 36, Code of Federal Regulations, Section 212. Establishes that responsible officials at local units, shall monitor the effects of motor vehicles on the environment, consistent with the applicable land management plan.

Title 36, Code of Federal Regulations, Section 219. Establishes the evaluation and monitoring requirements associated with land management planning, including, establishing three types of evaluations, roles for inventory and assessment activities in those evaluations, the expected commensurability between evaluations and expected risks or benefits, and requiring a plan monitoring program that addresses four specific purposes.

Title 36, Code of Federal Regulations, Section 222. Requires analysis of range allotments and that such analyses occur jointly with affected individuals and groups.

The Office of Management and Budget has also established government wide policies and requirements related to information resource management:

Office of Management and Budget Final Government-wide Information Quality Guidelines, February 1, 2002. Implements section 515 of the Treasury and General Appropriations Act for fiscal year 2001 (P.L. 106-554) by requiring each agency to establish implementing guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information, including statistical information, disseminated by Federal agencies.

Memorandum M-05-03, Office of Management and Budget. Establishes that important scientific information shall be peer reviewed by qualified specialists before dissemination by the Federal Government, including before disseminating influential scientific information or results from scientific assessments, and that each agency shall have the discretion to select a particular peer review mechanism based on benefits and costs of the review options, including the option of relying on existing findings of the National Academy of Sciences or on findings published in a refereed journal.

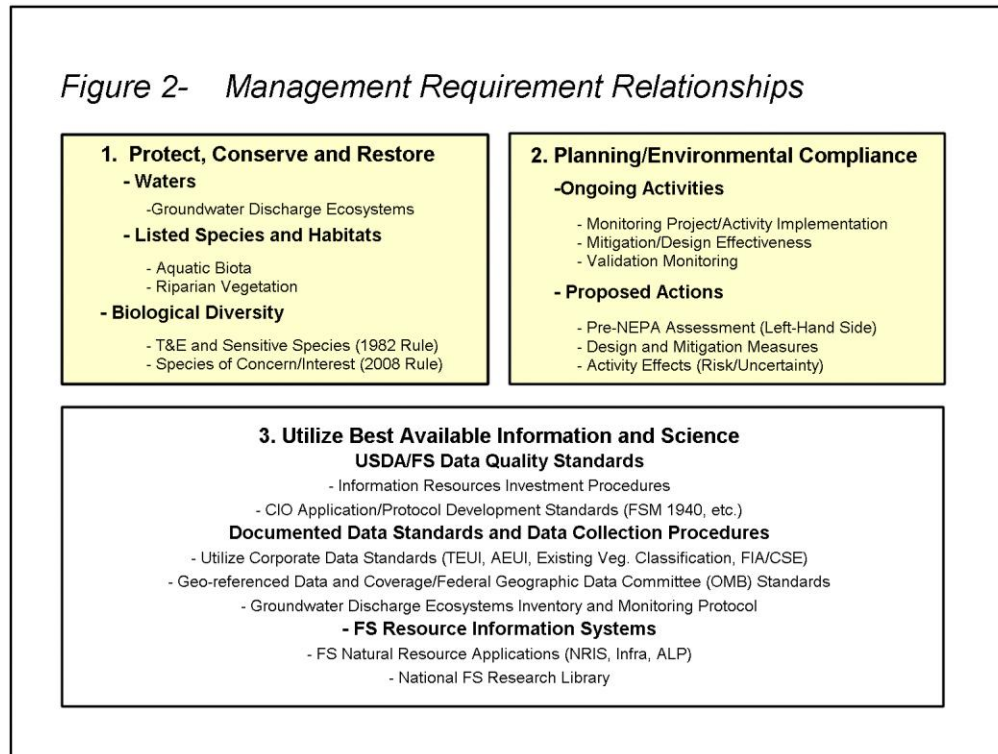
2.4 Summary

This collection of management requirements applicable to existing vegetation can be summarized into the following general objectives:

1. Support an affirmative agency obligation to protect, conserve, and restore waters, watersheds, listed wildlife and plant species and their habitats, and to conserve biological diversity.
2. Assess and disclose environmental effects associated with ongoing and proposed actions and activities.
3. Use the best available information and science to support agency decision making. Collect and maintain resource data with known data standards and data quality for use in agency decision making processes. Provide for information security.

The basic relationships of these management requirements are illustrated in Figure 2.

Figure 2- Management Requirement Relationships



Requirements for resource information and data management establish a foundation for the use of data in Forest Service business processes and provide for standardized approaches to data quality, data standards, and data systems within the agency.

3.0 Inventory and Monitoring Scale/Data Relationships

Forest Service decision scales and information needs are keys to development of vegetation resource information for management. A distinct relationship exists between management questions and the level and kind of existing vegetation classification, mapping and inventory. Business requirements define the necessary level of classification, mapping and inventory to meet a specific objective. A standardized approach permits a broad use of information to meet many needs. Dividing data into scale-dependent groupings simplifies the approach.

3.1 Agency Decision Making Scales

It is essential to develop a guide that directs existing vegetation classification, mapping and inventory to meet NFS business requirements. The use of different inventory, classification and map levels (National, Broad, Mid and Base) are designed to support this functionality.

To provide flexibility and ensure appropriate use of vegetation information, the relationship between business requirements (why data are collected) and vegetation classification, mapping and inventory must be clearly described. In addition, an understanding of how data are evaluated to address management requirements is necessary to assure associated costs and required skills are recognized in program formulation and development of cost estimates. Table 3-1 describes relationships between decision scales and data standards for vegetation (and other resources).

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Table 3-1. Existing vegetation map levels, business requirements and applications

Forest Service program areas	Forest Service business requirements	Ecological unit hierarchy	Ecological analysis scale (Range)	Potential natural vegetation classification	Existing vegetation classification	Existing vegetation map unit design	Existing vegetation map product examples	Data sources/ Sampling protocols	Map Extent
Map Level 1 - National									
Forest Inventory and Analysis (FIA), Resource Planning Act (RPA), International Programs, Fire and Aviation, Forest Health Monitoring (FHM)	National Strategic Inventory (FIA Phase I), Forest Cover, Forest and Rangeland Health/Sustainability	Division, province	ECOMAP 19971:30,000,000 to 1:5,000,000; gen poly size 10,000–100,000 sq. mi.	Groups of Series	NVC Formation Class, Formation Subclass, Formation, NFS Physiognomic unit, Major Land Renewable Resource Areas (MLRA)	National Land Cover Database, one or more NVC Upper Levels or groups of Formation Class, Subclass, Formations	National Land Cover Datasets, Landfire	Forest Health Monitoring (FHM), FIA, National Resources Inventory (NRI)	National (millions of square miles)
Map Level 2 - Broad									
RPA, FIA, Fire, FHM, Forest Planning and Monitoring	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	NVC Divisions, Macrogroups, Groups, Dominance types or alliances (e.g., Society for Range Management (SRM), Society of American Foresters (SAF) cover types)	One or more NVC Midlevels or groups of Divisions, Macrogroups, Groups, Cover types or Cover type groups, Dominance type groups	SAF forest type map, Gap Analysis Program (GAP), NLCD, Landfire	FHM, FIA, NRI	State or multistate or (20+ million acres)
Map Level 3- Mid									
Forest Planning and Monitoring, Fire, FIA	Forest/multiforest planning/monitoring, 4th/5th Hydrological Unit Code (HUC) Watershed Assessments, National Fire Plan Implementation (Forest Level) Forest and Rangeland Health Assessments, Terrestrial and Aquatic Habitat Assessments	Landtype 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., Vegetation Stand Structure [VSS])	R5 Classification and Assessment with Landsat of Visible Ecological Groupings [CALVEG] California Wildlife Habitat Relationships (CWHR), R1 VMAP, R3 Midscale EV Maps, GAP, National Wetlands Inventory (NWI)	FIA intensified plots, compartment exams, field training data plots	Forest or multiforest (50,000+ acres)
Map Level 4 - Base									
Project Planning, Forest Plan Implementation, Land Treatments	Forest Plan Implementation Project Planning and Land Treatments. e.g., Fuel Treatments, Grazing Management, Timber Management, Habitat Management, Range Analysis, Stand Exams, Effectiveness, Monitoring	Landtype, landtype phase	1:60,000 to 1:24,000; gen poly size < 1,000 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 Continuous Inventory of Stand Conditions [CISC], R2 Common Vegetation Unit [CVU], range allotment analysis maps	Stand exams, rangeland protocols, Terrestrial Ecological Unit Inventory (TEUI) integrated plots	5th/6th HUC Watershed or Project Area (< 50,000 acres)

3.2 FGDC Standards

To provide national standards for vegetation classification, the FGDC developed a National Vegetation Classification Standard (NVCS 1997, revised 2008). The standard has the following objectives:

1. To facilitate and support the development of a standardized vegetation classification for the United States and its use for information sharing.
2. To define and adopt standards for vegetation data collection and analysis used in support of the classification.
3. To maintain scientific credibility of the national classification through peer review.
4. To facilitate inter-agency collaboration and inter-agency product consistency.

The original (1997) NVC hierarchy had nine levels. These were based primarily on physiognomy, except the two lowest levels (alliance and association) which were based on floristic attributes. In 2008, a revision was undertaken to better integrate physiognomic and floristic criteria (Jennings et al. 2009). The restructured hierarchy contains eight levels, emphasizing physiognomy at the highest levels, both physiognomy and floristics at the middle levels, and floristics at the lower levels.

The NVCS is a “process standard”, not a strict classification system (except at the “Formation Class”, or highest level, in which classes have specific definitions). It creates a framework and defines criteria that a classification system should meet. Table 3-2 provides examples of the different levels of the 2008 NVC hierarchy (Faber-Langendoen, et.al. 2008.)

Table 3-2. Examples of the different levels of the 2008 NVC hierarchy.

Hierarchy for Natural Vegetation	Example
Upper Levels	
1 – Formation Class	Scientific Name: Mesomorphic Shrub and Herb Vegetation
2 – Formation Subclass	Scientific Name: Temperate and Boreal Shrub and Herb Vegetation Colloquial Name: Temperate and Boreal Shrubland and Grassland
3 – Formation	Scientific Name: Temperate Shrub and Herb Vegetation Colloquial Name: Temperate Shrubland and Grassland
Mid Levels	
4 - Division	Scientific Name: <i>Andropogon – Stipa – Bouteloua</i> Grassland & Shrubland Division Colloquial Name: North American Great Plains Grassland & Shrubland
5 - Macrogroup	Scientific Name: <i>Andropogon gerardii – Schizachyrium scoparium – Sorghastrum nutans</i> Grassland & Shrubland Colloquial Name: Great Plains Tall Grassland & Shrubland
6 - Group	Scientific Name: <i>Andropogon gerardii – Sporobolus heterolepis</i> Grassland Group Colloquial Name: Great Plains Mesic Tallgrass Prairie
Lower Levels	
7 – Alliance	Scientific Name: <i>Andropogon gerardii – (Calamagrostis Canadensis – Panicum virgatum)</i> Herbaceous Alliance Colloquial Name: Wet-mesic Tallgrass Prairie
8 - Association	Scientific Name: <i>Andropogon gerardii – Panicum virgatum – Helianthus grosseserratus</i> Herbaceous Vegetation Colloquial Name: Central Wet-mesic Tallgrass Prairie

This national standard requires all federal vegetation classification efforts to meet core data requirements in order to permit aggregation of data from all federal agencies. The Standard also requires that vegetation map units crosswalk to the National Vegetation Classification (NVC) hierarchy. This means that the composition of any map unit or inventory unit can be described in terms of one or more vegetation types at an appropriate level of the NVC hierarchy (NVCS 2008). All areas having typically 1% or more of their surface area with live vegetation cover are classified within the NVC (FGDC 2008).

The first version of the *Existing Vegetation Classification, Mapping and Inventory Technical Guide* (Brohman and Bryant 2005) used a vegetation classification system based on the 1997 version of the NVCS (FGDC 1997). The Forest Service vegetation classification protocol addressed in the revision of this technical guide is compatible with the 2008 NVCS.

4.0 Management Questions

Management questions are used to identify data elements and their resolution associated with different business requirements. The process is intended to reduce risk and uncertainty by providing data at a resolution commensurate with the decision being made. Limited resources make it essential to establish priorities and focus management intervention on those questions with the highest degree of risk and uncertainty and on those activities and decisions that where are most likely to influence the sustainability of ecological systems.

Cost is a key element in the agency's ability to implement decisions. This factor makes it essential to establish clear priorities and, when possible, relationships among management questions to focus agency and partner resources.

Vegetation data and information needs span jurisdictional boundaries and change over time, as does the vegetation itself in response to management and disturbance. The ability to organize data and conduct analyses across administrative boundaries is facilitated by the use of a common classification, mapping and inventory framework.

Management questions (and Technical Guide revisions) are identified using three primary sources:

1. Changes in Federal or agency policy and standards;
2. Reviews and evaluations of the current technical guide; and
3. Review of emerging business needs to support national programs.

4.1 Federal and Agency Standards and Policy Changes

Since publication of the Existing Vegetation Classification and Mapping Technical Guide in 2005, two substantial changes in Federal and agency standards have necessitated revision of the Technical Guide:

1. The National Vegetation Classification Standard (FGDC 2008) and revision of the standard the National Vegetation Classification (Faber-Langendoen, et.al. 2008) which applies to all Federal agencies.

2. Forest Service policy governing resource information management includes issuance of FSM 1940 – Inventory, Monitoring and Assessment Activities and adoption of the ***Information Resources Strategic Framework*** (US Forest Service, 2010).

2.4.1 Federal Geographic Data Standard

The 2008 Federal Geographic Data Committee standard (FGDC 2008) establishes process standards for Federal agencies for classification and mapping existing vegetation. The 2007 National Vegetation Classification (NVC) is a substantial revision of the 1997 hierarchy, which relied on physiognomic characteristics above the “alliance” level (Faber-Langendoen, et.al. 2008). Work on keys for “lower” levels within the NVC is ongoing and may not be completed for some time.

The FGDC process standard and changes in the NVC are not reflected in the 2005 Existing Vegetation Classification and Mapping Technical Guide, making it inconsistent with current Federal policy.

2.4.2 Agency Policy Changes

FSM Chapter 1940 describes agency policy, roles and responsibilities and procedures for resource inventory, monitoring and assessment. This new chapter of the Forest Service Manual (Inventory, Monitoring and Assessment Activities) was issued in 2009.

In 2010, the Forest Service also revised its strategy for managing resource information and adopted the ***Information Resource Strategic Framework*** (US Forest Service 2010).

These changes in policy and approach substantially revise the approach used to manage resource information from that described in the 2005 Technical Guide.

4.2 Review and Evaluation Recommendations

Use of the Existing Vegetation Classification and Mapping Technical Guide since it was published in 2005 has identified areas where guidance needs to be improved, new technologies and science change approaches and methods, inconsistencies with FGDC standards, and weakness in addressing evolving business needs.

The following section describes information gleaned from three separate reviews that identify needs for revision of the Technical Guide and other significant vegetation issues affecting agency performance.

4.2.1 Classification, Mapping and Inventory Workshop Recommendations

In 2007, Agency vegetation classification, mapping, and inventory specialists met to discuss business needs that had changed and to identify opportunities to improve the current Technical Guide. Workshop participants recommended a series of action items. Various issues were raised about map processes, scaling and appropriate use of data, implementing FGDC classification standards, process integration, statistical validity, non-forest information gaps and spatial modeling (US Forest RSAC 2007).

Recommendations for revision of the Existing Vegetation Classification and Mapping Guide resulting from this meeting include (not listed in priority order):

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

1. Review and Revise protocol for “map unit design” to improve standardization of aggregation of classes into viable map units considering scale and accuracy.
2. Add guidance for identifying what map attributes are useful and appropriate to map as continuous variables, and protocols for mapping these variables.
3. Add guidance and or standards for cartographic displaying and printing vegetation map products at different scales.
4. Review and validate map Accuracy Assessment standards, methodology for both statistical and utility assessments and overall accuracy, and add protocol for cost benefit analysis of increasing map accuracy considering smaller minimum mapping units as well as accuracy of attributes.
5. Review and validate guidance on pixels vs. polygons as mapping features.
6. Review and validate agency business needs and customers for each map scale; National, Broad, Mid- and Base-level.
7. Address database needs for developing reference tables, stewarding and populating FGDC classification descriptions, names and database codes for all levels of the revised National Hierarchy, including Alliances and Associations both formal and provisional types, for use in map unit design and map attribution.
8. Review existing guidance, and add protocols for updating maps and assessing accuracy due to change of existing conditions on the ground, vs. the production date of the current version of existing vegetation spatial data. Consider disturbances both natural and man caused as well as changes due to vegetation in-growth / re-growth.
9. Address issues with the status of floristic classifications available for mapping and revise guidance on consistency for across Regional use. Regions need to develop more consistent Dominance Type Classifications for addressing across regional issues such as the Sage Grouse. In the current guide, SAF and SRM cover type systems were identified for use in mapping until FGDC standard typing was available to meet this need. Moving forward in establishing and implementing the FGDC formal Middle Levels of the National Standards of: Division, Macrogroup, and Group are needed to replace the use of existing cover type systems.
10. Address and add guidance on how to integrate inventory efforts with mapping and classification efforts; to refine and maintain classification systems, improve map accuracies, and be more cost effective for the agency. Consider both forested and non-forest vegetation.
11. Review and revise guidance on use of sample based data for classification, mapping, accuracy assessment, and modeling efforts. Address and consider data storage and accessibility for classification, map and sample based inventory data.

12. Review and revised guidance on how to integrate the four hierarchical levels of National, Broad, Mid, and Base presented in the mapping process for classification and inventory processes.
13. Add to the guide and fully integrate Vegetation Inventory with Classification and Mapping for designing and accomplishing a statistically valid inventory for each level: National, Broad, Mid and Base. To raise the National recognition, emphasize the Mid level inventory as necessary to provide adequate National Forest Planning and Monitoring information for all vegetation both forest and non-forest. Discuss relationships with other technical guides, handbooks, and applications.
14. Add, identify and provide guidance on appropriate stratification, tabular compilations, and associated spatial products. Consider how different kinds of sample plots, stand exams, and FIA plot inventory data might be used, as well as how current the information must be to adequately represent current conditions. Consider current standards and protocols and or develop supplemental standards and protocols for statistically based inventories for each of the hierarchical levels for data collection, storage, compilation and analysis.
15. Add, identify and provide guidance and protocols for filling the information gap associated with non-forest conditions for each of the hierarchical levels.
16. Add guidance and protocols for spatial modeling and list of potential uses. Define and differentiate mapping vs. modeling. Address appropriate modeling for each of the hierarchical levels. Provide methodology on assessing statistical accuracy of surface predictions, reliability, and limitations of current applications. Discuss cartographic products, smoothing, filtering, and color palettes.

Data gaps were also identified during review of the draft 2007 FIA 5 year strategic plan that was also reviewed during this meeting. Participants recommended the extension of the FIA grid into all lands in all states would make vegetation inventory data comprehensive for all lands. As part of this recommendation, the creation of standard non-forest inventory protocols to be applied on all NFS lands was also recommended.

4.2.2 LANDFIRE General Management Evaluation

The Landscape Fire and Resource Management Planning Tools Project (LANDFIRE) produces maps and data describing vegetation, wildland fuel, and fire regimes across the United States. Partners include wildland fire management programs from the USDA Forest Service and the Department of the Interior. Vegetation data are used to generate products at the national and landscape level.

There is unprecedented use of LANDFIRE products for climate change, carbon related information (e.g. cap and trade), insect and disease as a large scale stress, and conservation/restoration strategy. LANDFIRE products are used for the new Cohesive Wildland Fire Management Strategy and sub-national levels. Most of the business needs cross large landscapes and all jurisdictions. There has been increased demand for products by previously unidentified stakeholders (e.g. state government). Resolving the current data issues and providing products at national scales with the support of additional partners will support collaborative approaches to landscape conservation issues.

In 2009, a management evaluation of the project suggested significant changes were needed to meet business needs (LANDFIRE General Management Evaluation Report (ver. 3.3, Dec. 14, 2009)) http://www.landfire.gov/documents_genmgmt.php. Recommendations address: vision and scope, organization and governance, data quality and integrity, communication, technology transfer, and organizational transition. Only data quality and integrity are summarized here:

Data Quality and Integrity –Data integrity is primary to the acceptance of LANDFIRE as a base federal program for wildland fire needs. Leadership in promoting standards and supporting the program is also important. Standards must include clearly defining the relationship between local data used for wildland fire programs and the national standards. LANDFIRE plans to implement FGDC NVCS Division, Group and Macro-Group class levels to provide continuous landscape coverage of vegetation cover types. The creation of national scale products would eliminate issues with edge-matching between certain map zones.

A major effort is needed to fix data and resolution accuracy issues, data gaps and inefficient update processes before the program will be adopted as a federal program. Data currency issues could be addressed by the development of a continuous and dynamic map update process. The integration of other operations and products such as NFPORS could result in efficiencies for many processes e.g. large scale disturbances. An integrated change management system would also ensure that duplication of effort is not occurring.

There is a pronounced need to address data gaps for non-forested lands (i.e., shrublands, grasslands, urban areas and woodlands). The LANDFIRE program management evaluation isn't the only process to identify this need.

LANDFIRE plans to rely on Natural Resources Conservation Service (NRCS) data to improve biophysical interpretations of grassland and shrublands. Better processes for obtaining and incorporating data on certain non-forested vegetation types are needed to improve map accuracy and descriptions of those types. National land cover data could be incorporated.

An outcome of interagency discussion of the General Management Evaluation is an effort to define a National Information Framework for Landscape Conservation. This framework would define agency roles in providing and stewarding datasets needed by multiple agencies to work across jurisdictions at larger scales.

4.2.3 California FRAP Review

California recently completed a statewide forest and rangeland assessment (FRAP) <http://frap.fire.ca.gov>. A review of this recent assessment and discussions with authors and analysts echoes of vegetation data needs from other assessments. Priorities include the ability to maintain a consistent, continuous scalable vegetation map. Information comes from several sources. The assessment revealed the need to enhance FIA to support climate change, threats and urban forest projects. Also lacking is a standard for gathering vegetation management activity information across agencies. The issue of data gaps included several topics. Data currency and non-forested land data across all lands were included. Other needs for the program include a better inventory of invasive species, existing condition of riparian areas and carbon stock assessments (need better above- and below-ground data).

The analysis team at the Remote Sensing Lab in Sacramento, California is a partner with the state on FRAP. The team was interviewed to provide information on emerging needs and data gaps related to vegetation classification, mapping and inventory in the Pacific Southwest Region (Region 5). The team has partnered with California FRAP to provide many products that are used for vegetation management (fire, fuels, watershed, carbon flux, threats, etc). This partnership has promoted development of consistent coverages on a large scale and across ownerships.

The Remote Sensing team highlighted several data gaps related to vegetation information. Data needs are expanding. There are a limited number of FIA plots and there is more reliance on these data to support analyses that provide information for an increasing set of business needs. Sample designs do not meet all needs and error estimates are too high in some cases (not enough data). The Region has intensified its' FIA program to fill information gaps in certain areas, certain vegetation types and for specific attributes. For calculating carbon stocks, the Region uses inventory strata developed from mid level vegetation maps and post stratified FIA plots. Grid intensification plots are used for strata averages. The above ground live biomass estimates are fairly good because the Region samples all lands. Problems are in the availability of specific volume equations for low value and non-industrial trees and estimating volume of shrubs and herbaceous vegetation.

Several data gaps exist for carbon assessments. The half-life of decaying dead standing and down is unknown. Urban forest data is missing. The carbon consumed in wildfire, based on fire severity is unknown.

Data currency is being addressed with FIA plots (P2 and intensification plots) which are targeted for re-measurement "off cycle" if a disturbance activity has occurred since the last measurement. This enhanced inventory program enables the Region to better assess current conditions and trends.

The scale and map issues that the Remote Sensing team encounters are most apparent when using vegetation maps for assigning surface fuels. Difficulty with LANDFIRE products occur when combining with other data sources to model all lands. LANDFIRE data is usually coarser, and has a different map scale. The Region also uses the previous 5 years of activities from Forest Service Activity Tracking System (FACTS) as input for fuels assessment work.

The focus on watershed restoration in the state is to increase the quantity and quality of water. Watershed Condition Assessments are at the HUC 6 level, roughly 10,000 to 30,000 acres in size. This analysis uses all the vegetation map and inventory sources, and surface fuels and recent activity information to assign a current condition and determine where treatments are needed. Data gaps in riparian areas are known. Aquatic habitat and riparian vegetation condition are needed to assess water quality and fish and wildlife habitats. FIA plots have not adequately sampled riparian areas.

4.3 Analysis and Evaluation Methods

An extensive review of current and emerging business requirements provided the need for vegetation data not addressed in the current Technical Guide or data needs not being met by agency inventory programs. This review will only focus on those needs for direction on vegetation, classification, and mapping. When possible, inventory data needs will be captured and presented to the SLM-BOD for their consideration.

New tools are being developed to meet the business needs described in the ***FS Action Plan for the Nation's Forests and Grasslands*** (USFS 2011). Most of these tools currently rely on and use existing

data, while some demand new information. Future data needs have also been identified through review processes.

A primary theme characterizing the difference between emerging and past business needs is the need to apply tools to larger geographic areas. In the past, the Agency has performed much work at the Base (project) level and has used Mid-level inventory to meet most needs (land management planning). Emerging analysis and evaluation methods and management focus require larger areas for analysis and assessment, which is supported by current technology.

4.3.1 Standard Data Management Project

The Standard Data Management (SDM) project has two objectives:

1. To meet agency policy needs related to inventory, monitoring and assessment (IM&A) activities; and
2. To ensure that the field has appropriate tools to implement agency policy for IM&A activities.

Activities underway are addressing the seven capability areas on direction and tools that were identified in the Line of Business Study. The sponsors of the SDM project have approved the concept of using the Resource Inventory and Monitoring Handbook (FSH 1909.xx) as a means of documenting appropriate results from the SDM capability areas in addition to the implementation policy for FSM Chapter 1940. The SDM Core Team provides staff support to the Information Management Council (IMC) in addressing as part of their work on SDM and the development of the FS directives (FSM Chapter 1940 and the supporting FSH 1909.14).

The IMC chartered the Sustainable Landscape Management Board of Directors (SLM-BOD) to address agency vegetation information management issues. The SLM-BOD performs roles and responsibilities for vegetation information management. The SLM-BOD strategy for evaluating vegetation information management is being developed. It will identify issues and challenges to effective vegetation information management. The Agency's decentralized history has allowed the proliferation of applications serving a single purpose, function or business. This multi-year strategy will promote an open dialogue to improve Agency vegetation information by recognizing overlap in disciplines, applications, landscape, and government/public boundaries.

In 2010, the SLM-BOD began working with NRM to conduct a comprehensive assessment of how vegetation, ground cover and soil data are managed and used in the Agency. The 2009 NRM NRIS Report to Customers showed low use numbers (2 forests in 2009) for the NRM NRIS Inventory and Mapping application and the Rangeland Inventory and Monitoring application. Other NRM applications that manage vegetation data are used extensively (Invasive Species – 68% of forests in 2010). Still other external databases (e.g. FIREMON) are not readily accessible to corporate data users. National protocols are keys to quality data, but many factors affect the acceptance and use of national applications.

The SLM-BOD is considering a draft Strategy for Advancing Vegetation Information Management. The strategy includes a national application inventory, identification of stakeholders, development of a process to evaluate impacts of recommendations, and dedicated leadership to follow through

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

and implement decisions, and a communication plan. SLM-BOD will select a prototype topic area and charter a work group to conduct the process.

The SDM Team has inventoried and begun to characterize national applications dealing with vegetation information management. Table 4-3 identifies applications used across the agency. Many of these were identified in Table 3.1. These applications are organized into three groups: (a) Analysis, (b) Inventory and (c) Activity Tracking. This inventory provides the basis for identifying vegetation information and data needed to support agency business applications. Note: Map Level is assigned to the outputs or data products developed by the application.

Table 4-3. National Applications Utilizing Vegetation Information

Application	Description	Map Level
Analysis Applications		
BehavePlus	A PC-based system that uses tabular data for fuel (canopy, crown, moisture), landscape and weather attributes to model fire behavior, effects, and the fire environment.	3-Mid or 4-Base
FARSITE - Fire Area Simulator	Fire behavior and growth simulator uses established fuel models and user input for canopy, crown, fuel moisture, landscape and weather attributes to display two dimensional growth models.	3-Mid or 4-Base
WFAS - Wildland Fire Assessment System	Integrated, web-based resource to support fire management decisions. Uses fuels, vegetation and weather data to provide temporal and spatial views of fire weather and fire potential, fuel moisture and fire danger	2-Broad
FFI - FEAT/FIREMON - Fire Ecology Assessment Tool/ Fire Effects Monitoring and Inventory system) Integrated	FFI combines FEAT and FIREMON to store and analyze ecosystem data for fire management. FIREMON databases use plot-level data for vegetation, soil, and fuel load. FIREMON Analysis Tool (FMAT) calculates summaries and creates exports. FEAT database is used to support monitoring of fire effects (NPS). It can be used to define strata for monitoring or sampling based on fire history.	2-Broad
FFP - FireFamily Plus	Summarizes fire weather and computes fire danger indices. Uses the National Interagency Fire Management Integrated Database (weather and occurrence).	2-Broad
NatCRS - National Timber Cruise	Calculates timber volumes using volume estimation. Contains national tables/information	4-Base
Forest Inventory Data On-Line (FIDO)	Corporate FIA program area that has a web application to access FIADB for generating forest statistic summaries and Google maps for a given area of interest.	1-National and 2-Broad
Forest on the Edge (FOTE)	Corporate project that produces maps/reports to display where/how private forest product services (timber, wildlife habitat) might be affected by development, fire, pests and pollution. Phase 1 used National Land Cover Dataset, census data and USGS HUC4.	1-National
NIMS-CS National Information Management System - Compilation System	Corporate system that provides a platform for processing FIA data and posting it on the Web. Implements national algorithms, lists of values, and quality assurance.	1-National
Multiple Resource Analysis and Geographic Information System (MAGIS) and MAGIS Express	Spatial decision support system for integrating land management and road access issues to develop schedules of treatments and road activities Requires attributed polygons for vegetation stands, a road network and a treatment polygon.	2-Broad and 3-Mid

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Application	Description	Map Level
TEUI Toolkit - Terrestrial Ecological Unit Inventory Toolkit	Spatial and analytical tools that use landscape and field plot data (soil, PNV, existing vegetation) to create and evaluate TEUI map units. Modeling to determine potential wildlife and plant habitats using occurrence data in conjunction with other geospatial data sets is also supported by the Toolkit's analysis procedures.	3-Mid
FS WEPP Interfaces (Water Erosion Prediction Project)	Corporate model used to evaluate erosion and sediment delivery. Uses plant community growth/decomposition, soil, climate and landscape data. It is not scale-dependent (NA).	NA
Inventory Applications		
IMPP - Inventory and Monitoring Program Planning Database	Uses outputs from other FS systems to develop program priorities.	2-Broad
NRM NRIS - Natural Resource Manager – Natural Resource Information System	Supports resource information collection and analysis. Users can enter, edit and analyze air, watershed, wildlife, visitor use and other types of data. Includes plot and polygon level data for vegetation composition, structure and management/treatment.	All levels
LANDFIRE	Uses vegetation cover type, composition and structure and fuels data with remote sensing techniques to describe and map potential and existing vegetation, fuel characteristics and historical fire regimes conditions.	2- Broad and 3- Mid
LANDFIRE Reference Database (LFRFDB)	Database of 800,000+ georeferenced plots used to train LANDFIRE products.	4-Base
MTBS - Monitoring Trends in Burn Severity	Models burn severity and fire perimeter maps of large fires across the nation using LANDSAT imagery.	1-National
National Hierarchy of Ecological Units - TEUI	Corporate standard for classifying and mapping national integrated inventory of ecological units. Landscape (PNV series/subseries) and Land unit (PNV subseries, associations and association phases) supported. Follows NCSS and NVCS standards.	3-Mid
FIA - Forest Inventory and Analysis	The national census of America's forests collects, analyzes, and reports status and trends of America's forests. The monitoring component collects plot- and stand-level data for site, vegetation composition and structure, fuels and soil. Provides a suite of analysis tools (FIDO, TPO, FSVEG) Sample intensification can provide accurate data for smaller areas.	1-National and 2-Broad
NRM Infra	Web-based data entry forms and reporting tools that enable Forests to manage information about constructed features, land units, and permits. Includes field-collected vegetation data for Range allotment monitoring.	1-National and 2-Broad
Activity Tracking Applications		
National Fire Plan Operations and Reporting System (NFPORS)	Interagency reporting system for tracking hazardous fuels and restoration and rehabilitation projects. Accomplishments reporting under National Fire Plan.	1-National and 2-Broad
NRM FACTS - Forest Activity Tracking System	Corporate database to plan, track and report activity data. Includes invasive species treatment, timber sale information (TIM Contracts and Permits), NEPA decisions and KV trust fund plans. Reports/maps at the national level and interfaces with NFPORS.	1-National
NRM TIM - Timber Information Manager	Corporate system that produces timber sale and forest product contracts, tracks payments, collections, etc. Reports at the national level and interfaces with FACTS.	1-National

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Application	Description	Map Level
Wildlife, Fish, Rare Plant Management System (WFRP)	Corporate system that provides web access to the database that tracks accomplishments (conservation, restoration) in the wildlife, fish and rare plant resource areas. Contains several reports and a query interface.	1-National
WebDET	Corporate web-based data entry and reporting geodatabase tool designed to support the Forest Stewardship Program. Tracks activities (planned and accomplished) and creates products based on those.	1-National
TPO - Timber Products Output	FIA program area that surveys timber mills for data to produce summary tables of trees (by species), product output, mill residue etc. to evaluate ecological and economic impacts	1-National
Forest Health Accomplishment Database (FAD)	Corporate database that tracks Forest Health Management Program funded accomplishments and project dollars. Provides states with funds to conduct forest health activities (pest-related) in a standardized manner.	1-National

These applications and tools are used by the Forest Service to maintain and analyze vegetation information. The list is not complete. It illustrates the magnitude of applications available, and those which render similar products. Most applications were designed for service-wide reporting. They create products at the National map level and use large scale vegetation attributes/classifications. The majority of the applications do not share information, as they were conceived for a specific need. Many are not FGDC compliant.

The Forest Service has vegetation information management needs at all levels, for all lands, and across all ownerships. It needs a standardized, efficient and integrated resource inventory and reporting system. This SLM-BOD project will assess where economies may occur, and indicate where complementary functions exist thereby working toward a comprehensive and strategic system.

4.3.2 Climate Change and Vulnerability Assessments

Climate change is a global issue and an emerging challenge for land managers. There are profound and measurable effects on vegetation e.g. type conversions, changes in growth, carbon sequestration, all have impacts on land-use patterns, land management, and sustainability. Carbon accounting is complex and more information is needed to support calculations. The need to assess impacts exists at all scales but the development of tools is just emerging.

Climate Change Score Card - The Climate Change Performance Scorecard (2011) is part of an Agency strategy to built adaptability into land management. The tool includes direction on the appropriate scale for its' application. Annual reporting is expected and complete compliance by 2015.

<http://fsweb.wo.fs.fed.us/chief/climatechange/scorecard%20guidance%20document%201-21-2011.pdf>

Several Climate Change score card elements utilize vegetation information:

Element 6 - Vulnerability Assessments: Vulnerability assessments can be performed at the unit, state, multi-unit or regional scale. Understanding what resources are most vulnerable and the interactions of climate change and other stresses can help us prioritize actions.

Element 7 -Adaptation Activities (strategies): Adaptation Activities tend to target the most vulnerable. Strategies are typically developed at the Unit level, but sometimes broader. Adaptive strategies require adjusting activities and decision-making processes to ensure that our lands continue to provide benefits under a changing climate.

Element 8 – Monitoring: Monitoring is critical in identifying when to adjust. Most efforts are being applied to scales larger than the Unit. Monitoring should have a unified, multi-scaled approach that can detect and evaluate national, regional, and local trends while also following corporate protocols and standards. FIA, Watershed Condition Framework and Forest Health Monitoring program are examples of programs that meet some climate change monitoring needs.

Element 9 - Carbon Assessments: Carbon Assessments are a complex process. Assessments may be made at the Unit, state, multi-unit (landscape) or regional level. It is critical to understand how carbon storage varies across the landscape, and how disturbances and management actions affect carbon stocks. The Forest Vegetation Simulator (FVS) is an example of a climate change evaluation tool.

Climate Vulnerability Assessments –Climate Vulnerability Assessments have been performed on a number of Forests. The Chequamegon-Nicolet National Forest is developing a Climate Change Response Framework to help identify management challenges posed by uncertain climate change. The process will involve an ecosystems vulnerability assessment to identify the ecosystem components most vulnerable, stakeholder discussions on opportunities for partnerships, and scientific evaluation of climate change and the need for monitoring.

4.3.3 Watershed and Terrestrial Condition Assessments

Implementation of the FS Action Plan relies upon several new evaluation and assessment methodologies:

Watershed Condition Assessments - Implementation of watershed condition assessments (USDA FS 2010) required the classification of all 6th code HUCs containing any NFS lands. This watershed classification approach was designed to be a rapid, coarse, office assessment to be completed in a short period of time by local interdisciplinary teams. The assessments provided a base for watershed condition and a way to prioritize watershed improvement.

Three condition classes were based on geomorphic, hydrologic and biotic integrity: functioning, at risk and impaired. Watersheds are by definition hierarchically nested and can be viewed at a variety of spatial scales. The vast amount of information generated by these assessments is managed in the newly created corporate system “Watershed Classification and Assessment Tracking Tool (WCATT)”.

Terrestrial Ecological Integrity Assessments - Work on a Terrestrial Ecological Integrity Rapid Assessment is underway (Dave Cleland 2011). This new system would parallel and complement the Watershed Condition Framework and is focused on terrestrial resource conditions. Landscape level assessments are needed to support Agency programs like Monitoring Trends in Land Change and the All Lands Conservation initiative.

Assessments are performed on much larger areas than in the past and with more partners. Issues associated with assessments on larger areas include the need for more information on non-forested lands, the need for information on lands not under agency management, and the ability to seamlessly model or map larger areas.

4.3.4 Fire Behavior and Modeling

A review of fire- related applications revealed a growing number of applications and tools related to fire behavior and fire modeling. These applications use much of the same information as fire applications listed in Table 4.3 and operate at the 3- Mid and 2-Broad Map Levels. Though no new business requirements were identified, applications illustrate the growing body of fire-related tools that function at these levels.

Vegetation Dynamics Development Tool (VDDT) uses vegetation state and transition models (cover type and structure) to examine the role of various disturbance agents and management actions at the Broad map level. It contains basic information on vegetation and relationships that can be edited by the user. VDDT is an analytical “shell” that can be used to develop data products at all four map levels.

Wildland Fire Decision Support System (WFDSS) uses data from a variety of sources to document fire management decisions on wildland fire incidents. Three primary data sets are used: (1) burn probability generated by fire behavior models like FARSITE & BEHAVE, (2) values at risk provided by agency administrators or the RAVAR model, and (3) fire severity data developed using fire behavior models. Data products are developed at both 4-Base and 3-Mid Map Levels

Fire Program Analysis (FPA) provides land managers with a common interagency process for planning and evaluating the effectiveness of fire management strategies. Analysis is performed at the 2-Mid Map Level.

4.3.5 Draft Handbook and Technical Guides Review

Review of the following handbooks and guides nearing publication did not provide any new business requirements, rather the need to have the right data at the right time, with the correct resolution in a continuous product to meet the Agency needs.

Rangeland Handbook The handbook references the Existing Vegetation Technical Guide for classification and mapping. Chapter 20 “...recommend(s) that the NVCS alliance level, or the Existing Vegetation Classification and Mapping dominance type floristic level, be used as a minimum for designing map units.” Many decisions are made at the base level, but also mid level. Standard protocols have been developed to collect inventory data. However, they have mostly been applied at the base level. A draft handbook was being circulated for review at the time this analysis was conducted.

Wildlife Habitat Monitoring Technical Guide This Guide directs monitoring of wildlife habitat. Collected information may include vegetation, site and setting, and wildlife attributes. Monitoring areas range in size from fine (2 sq. m) to coarse (acres) depending on species. Management decisions will require some sort of condition or trend assessment. Ecological classification and map units will be needed for interpretations. A draft handbook was being

circulated for review at the time this analysis was conducted.

http://fsweb.wo.fs.fed.us/wfw/weu/weu_habmontechguide.html

Riparian Vegetation Monitoring Technical Guide The key concepts lean heavily on fluvial delineation guidelines, existing vegetation communities and the need to make management decisions based on hydrology, soil and vegetation characteristics. Sampling levels are both project level and landscape level. Some existing riparian monitoring methods depend on stratification by stream, landscape and vegetation characteristics. Vegetation classification is not restricted to a class level. A mapped polygon will be needed in which to apply a sampling strategy and management scenario. Vegetation classification is needed to create a condition or trend assessment framework. <http://www.fs.fed.us/r4/resources/riparian/index.shtml>

Ecological Site Descriptions The NRCS, BLM, and FS have an MOU (2010) to develop and use ecological site classifications and descriptions for inventory, monitoring, and assessing for rangelands. The agencies will coordinate in the identification, classification, description, and delineation of ecological sites; and jointly participate in quality control in the development of ecological site descriptions. Table 4.4 describes the classification and mapping levels associated with ecological site description.

The FSM Chapter 2060, as amended, also establishes the National Framework for Ecological Units, Terrestrial Ecological Unit Inventory Tech Guide, and development and use of ecological sites as agency policy. Implementation of ESD's will fully complement the system for rangelands. Field data will be collected for vegetation, soil and site attributes. The NRCS does not make plot level data available in NASIS, only map units. It will be necessary to maintain plot level data in the corporate NRM system. Map units will be similar in granularity to NRCS soil map units and derived from plot and transect data. Existing vegetation classification, potential vegetation classification and map unit classification will be required for this work. Map units will be necessary for applied management strategies.

A draft handbook is being circulated for review. Appendix A - Table 1 in the draft is similar to Table 4-3.

Groundwater Dependent Ecosystems Inventory Field Guides These Field Guides provide standard protocols to inventory and monitor groundwater dependent ecosystems. They specifically apply to minerogenous wetlands, those supported by groundwater which has had mineral soil/bedrock contact. This includes springs, fens and groundwater dependent wetlands such as marshes and swamps. The protocol, in part, may be applicable to other groundwater supported sites.

The location and extent of these ecosystems must be georeferenced. Site locations may be identified via existing map products (geology, soils, existing vegetation) and will be mapped in the field. Spatial area tends to be Level 1 (Base) map level (small springs, 2 sq. m to much larger wetlands, acres). Field data on vegetation, soil, hydrogeology, water, fauna, TES and Invasive species and other characteristics are collected. Vegetation is one of the keys to site ecology and the protocols supports NVCS vegetation types.

Data products from the Level I inventory are generally developed at 3-Mid Mapping Level, while Data Products from the Level II inventory are generally developed at the 4-Base Mapping Level.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

A draft protocol is available at:

<http://www.fs.fed.us/r4/projects/gwde/documentation/index.shtml>

Table 4.4 – Ecological Site Description Classification and Mapping Systems

Hierarchical Planning and Analysis Levels	Ecological Classification Systems			Ecological Mapping Systems			
	Ecosystem Classification NRCS and BLM	Ecosystem Classification FS	Potential Natural Vegetation Hierarchy	National Vegetation Classification NVC	National Hierarchical Framework of Ecological Units	NRCS Soil Geography Hierarchy	NatureServe Ecological Systems
Continental and Region (Ecoregion)	NA	Macro Climate PNV Series Groups	PNV Groups, Sub-classes	Formation/ Division	Domain, Division, and Province	Land Resource Region	Macro-ecosystem Scale
Subregion	NA	Macro Climate, Physiography, PNC – Series, Formation	Plant Series: Formation	Division/ Macrogroup	Section and Subsection	Major Land Resource Area Land Resource Unit General Soil Map	
Landscape	NA	Geomorphology Geology, Relief Potential Natural Community (PNC) Series; Ecological type	Plant Series: Habitat Type Group	Group/Alliance; (Dominance Type)	LTA	NA	Ecological Systems
Land Unit	NA	Ecological Type	Potential Plant Association; Habitat type	Association/ Alliance	LT	Detailed Soil Map	Micro-ecosystem Scale
	Ecological Site	Ecological Type	Potential Plant Association Phase; Habitat type phase	Association	LTP	Soil Series	
Sites	Vegetation plot and soil series	Sample site (soil pedon/vegetation plot)	Vegetation plot	Vegetation plot	Integrated Plot	Soil Pedon	NA

5.0 Framework and Scope

Business requirements for existing vegetation information have become more complex over time. The ability to access and analyze vegetation information for all vegetation types and across all lands is paramount to effective land management at the landscape/watershed scale and collaborating and maintaining partnerships with our conservation partners. Vegetation classification, mapping, and inventory processes that provide Map Level 3 (Mid) data products are the operational link between local land and resource management at Map Level 4 (Base) and Map Level 2 (Broad). Agency business requirements for data products at Map Level 3 are evolving and receive increased emphasis as demonstrated by the analysis presented in Section 4.0.

To respond to this need, the Agency Information Resource Board (IRB) and Sustainable Landscape Management Board of Directors (SLM-BOD) sponsored and chartered a team to update the ***Existing Vegetation Classification and Mapping Technical Guide*** (GTR WO-67) (Brohman and Bryant, 2005) which focuses on Map Level 3 processes. Oversight and progress on Information Asset projects like this revision effort are monitored by the CIO and IRB. Documentation on the project can be found at: <http://www.fs.fed.us/emc/rig/protocols/vegclassmapinv.shtml>.

5.1 Technical Guide Revision Scope

In June, 2010 the Technical Guide revision Core Team evaluated sixteen recommendations that were developed at the 2007 Classification, Mapping, and Inventory (CMI) Workshop (RSAC 2007) and added two others (modeling guidance and cost/benefit analysis for base and mid level mapping). “Like” issues were associated and ranked to define the scope of the project. The recommended project scope, schedule and approach were submitted to the project Steering Team and SLM-BOD for review and were approved.

The following working groups were established to develop new content for the Technical Guide and to revise existing portions of the guide:

Inventory Integration – Describe the process to integrate inventory data into classification and map products for all four levels (National, Broad, Mid and Base).

Map Accuracy/Utility – Address map quality issues and make recommendations on quantitative map accuracy assessment and qualitative map utility assessment.

Map Unit and Feature Design – Add relevant information to guide information needs assessment process and organize current Guide sections dealing with this topic. Address appropriate use, accuracy assessments, cost analysis, map features, treatment of attributes.

Map Maintenance – Define a process for map maintenance including when, why, how and identifying triggers. Include discussion on accuracy assessment.

Business Needs Validation – Review and validate whether current standards and protocols meet existing vegetation needs. Review documentation, interview contacts inside and outside the Agency and identify appropriate classification, inventory and mapping at all four levels (National, Broad, Mid and Base) for emerging needs.

Non-forest Information gaps – Develop a policy issue briefing paper for the Steering Team to discuss with the SLM-BOD.

The vegetation classification standards adopted by the Federal Geographic Data Committee (FGDC) adopted (FGDC-2008. STD-005-2008 [Version 2]) in 2008 must be incorporated in the ***Existing Vegetation Classification and Mapping Technical Guide*** (Brohman and Bryant 2005). Consistent procedures for compliance with FGDC standards are essential to facilitate landscape-scale coordination across administrative units and with our conservation partners. Tasks associated with this revision effort are divided into:

Phase 1 revisions address new standards (FGDC), remove policy statements, reformat the Guide to be consistent with the draft FSH 1909.14 Section 20, and remove irrelevant content.

Phase 2 revision scope involves addressing the 2007 CMI Workshop recommendations.

5.2 Policy Issues Beyond the Scope of this Effort

The USDA Forest Service depends on inventory and monitoring data and information to carry out its mission. Two policy issues illustrate this situation.

5.2.1 Vegetation Classification and Mapping Standards

Vegetation classification and mapping across the agency has been driven by local or sponsoring unit needs. The ability to correlate data products with other NFS units or with adjacent land managers has frustrated many efforts to work at larger, landscape scales. The FGDC vegetation standard is written as a process standard, not as a standard data requirement to allow agencies to evaluate this need and when appropriate establish standard data requirements.

This effort will not address development and establishment of national vegetation classification and mapping standards and will use the flexibility established in the FGDC vegetation standard that requires the ability to “cross-walk” data products to the National Vegetation Classification System. If such standards are warranted they will be addressed as part of the SLM-BOD’s vegetation information strategy.

5.2.2 Inventory Program Information Gaps

Previous and ongoing vegetation inventories have often either ignored specific existing vegetation types, have been performed at the Base Map Level for small areas, or only on NFS lands. This has created inventory data coverage “gaps” compromising the agency’s ability to effectively manage vegetation resources across the agency.

Numerous information data gaps have been identified during various reviews (see Section 4.3). These information gaps are primarily for vegetation from non-forested lands (shrubland, woodland, grassland) and vegetation information from non-Forest system lands. The Forest Service and its’ partners need a spatially complete and comprehensive vegetation inventory product to meet business requirements for broad- and mid-level assessments.

The project team has provided the SLM-BOD a briefing on these needs and will not address the issue as part of the revision effort. <http://www.fs.fed.us/emc/rig/protocols/vegclassmapinv.shtml>

References

- Brohman, R.; Bryant, L. eds. 2005. Existing Vegetation Classification and Mapping Technical Guide. Gen. Tech. Rep. WO-67. Washington, DC: U.S. Department of Agriculture Forest Service, Ecosystem Management Coordination Staff.
- Cleland, D., P. Avers, W. McNab, M. Jensen, R. Bailey, T. King, and W. Russell. 1997. National hierarchical framework of ecological units. Pp. 181-200 in Boyce, M. S.; Haney, A., ed. 1997. Ecosystem Management Applications for Sustainable Forest and Wildlife Resources. Yale University Press, New Haven, CT. Available online at http://files.dnr.state.mn.us/natural_resources/ecs/nhfeu.pdf.
- Faber-Langendoen, D., D. Tart, A. Gray, B. Hoagland, O. Huber, C. Josse, S. Karl, T. Keeler-Wolf, D. Meidinger, S. Ponomarenko, J-P. Saucier, A. Valazquez-Montes, and A. Weakley. 2008 (in prep). Guidelines for an integrated physiognomic-floristic approach to vegetation classification. Hierarchy Revisions Working Group, Federal Geographic Data Committee, Vegetation Subcommittee, Washington, DC.
- Federal Geographic Data Committee (FGDC). 2008. National Vegetation Classification Standard FGDC-STD-005-2008 (Version 2). Vegetation Subcommittee, Federal Geographic Data Committee, FGDC Secretariat, U.S. Geological Survey, Reston, Virginia. Available at: <http://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation>
- FGDC. 2000. Powell, D.S. 2000. Forest Service Framework for Inventory and Monitoring. Unpublished white paper.
- Jennings, M. D., d. Faber-Langendoen, O.L. Louckes, R.K. Peet, and D. Robers. 2009. Characterizing Associations and Alliances of the U.S. national Vegetation Classification. Ecological Monographs 79.
- U.S. Forest Service - Remote Sensing Applications Center (RSAC). 2007. Classification, Mapping and Inventory Workshop Proceedings. RSAC-4026-DM 1.
- U.S. Forest Service. 1992. Information Management: A Framework for the Future. Information Systems Staff. USDA Forest Service, Washington, DC.
- U.S. Forest Service. 2007. Monitoring and Evaluation Framework, Ecosystem Management Coordination Staff. USDA Forest Service, Washington, DC.
- U.S. Forest Service. 2010. Information Resources Strategic Framework. Chief Information Officer. USDA Forest Service, Washington, DC.
- U.S. Forest Service. 2011. Forest Service Action Plan for the Nation's Forests and Grasslands. Office of the Chief. USDA Forest Service, Washington, DC.

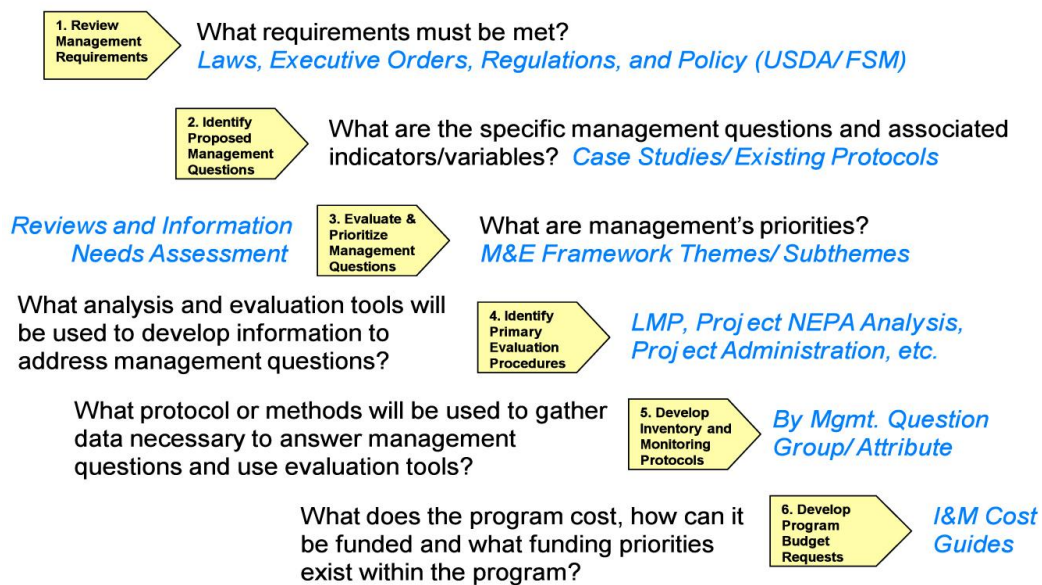
Appendix A – Business Requirements Analysis Process

A structured inquiry is essential to the identification and evaluation of business requirements supported by inventory and monitoring protocols. A detailed review of the management requirements and questions provides transparency and the ability to reexamine requirements and priorities over time. This analysis provides the foundation for maintenance and revision of protocols and technical guidance.

A six-step process is used to develop inventory and monitoring protocols as illustrated in Figure 1. This process conforms to direction in FSM Chapter 1940 and with procedures established by the USDA and Forest Service Chief Information Officers. The purpose is to help organizations avoid a common problem-solving trap; starting a project by jumping into development activities rather than spending time identifying the problem and defining requirements. From a practical perspective, developing a well-structured plan makes perfect sense, but this approach requires organizational discipline to accomplish.

Figure 1 – Inventory and Monitoring Technical Guide Development Process

Based upon FSM 1940 requirements



Identification of agency business requirements occurs in steps 1-2 in Figure 1. Business requirements originate from laws, regulations, and policy as well as management issues and concerns. Once business requirements are documented and understood, the next steps are to determine management's priorities for addressing these requirements and to evaluate how data will be used to address these requirements and questions.

In step 5, it becomes possible to identify inventory and monitoring methods best suited to gather the data needed to address priority business requirements. In this instance, the goal is to develop protocol components that allow local units to mix and match inventory and monitoring methods to meet their local business needs. This is essential to acknowledge the variation of business requirements across the NFS.

The final development process (step 6) involves the creation of cost guides. Cost guides assist local NFS units to development realistic budget requests and estimates for costs associated with proponent-generated activities affecting specific resources.

Business Requirements

Adaptive management requires a clear understanding of the underlying business requirements for land management activities. In some instances policy and direction limit management's ability to respond to identified needs. Business requirements stem from two primary sources (see Table 1), management requirements and management questions.

Table 1 – Business Requirement Sources

Management Requirements	Management Questions
<u>Laws</u> – A variety of Federal statutes establish Forest Service authority for managing resources and procedural requirements. <u>Executive Orders and Presidential Directives</u> – Specify procedures and requirements applicable to all government agencies for the management and protection of resources. <u>Regulations</u> – Establish the processes and policy for conducting land and resource management activities. <u>Departmental Policy</u> – Establish procedures and policies for USDA agencies responsible for or potentially affecting resources. <u>Agency Policy</u> – Establish agency-specific procedures for regulatory requirements if not addressed directly.	<u>Land Management Plans</u> – The purpose of LMPs is to establish desired outcomes (goals and objectives), standards and guidelines, and monitoring requirements. This may include: – Ecological Context – Are ecological systems functioning and disturbance processes operating within the natural or desired range of variation? Are human pressures or changes in ecological systems inducing changes to the ecological context in which species reside? – Species Context – Are habitat relationships affected by management or ecological factors creating risk to species persistence? – Resource or Area Plans – Refine interpretations and requirements for specific resources or areas. <u>Monitoring</u> – Includes: – Implementation – Are projects and activities being implemented as designed? – Effectiveness – Are mitigation measures, best practices and design features effective in mitigating anticipated effects? – Validation – Are conservation actions achieving desired outcomes?

Management Requirements

Complex legal requirements and variable management issues make it difficult to define a discrete set of business requirements applicable to all NFS lands. At times, laws and regulations provide the opportunity for States and Tribes to establish additional regulations for the protection of resources. This creates an even more complex relationship between management requirements and NFS. Protocols must be designed to allow for local additions within a national framework.

To accommodate this need, resource protocols will be developed using the “core variable concept” (Powell 2000). This concept is employed in a number of national inventory and monitoring protocols, most notably the Forest Inventory and Analysis Program. Use of this concept allows for regional and local additions to meet specific information needs within a national protocol.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

There are three primary groups of management requirements in which Forest Service business processes related to the management of natural resources are organized:

- A. Resource Management
- B. Planning and Environmental Compliance
- C. Resource Information Management

These groups will be used to identify business requirements originating from laws, regulations and policy.

Management Questions

Management questions are intended to focus management's efforts on refining operating assumptions and reducing risk and uncertainty associated with decision making. It is essential to establish priorities and focus management intervention on those questions with the highest degree of risk and uncertainty and where actions are likely to influence the sustainability of ecological systems or species diversity.

Cost and cost efficiency are critical factors in the agency's ability to initiate conservation measures and practices. Therefore, it is essential to establish clear priorities and, when possible, relationships among management questions to focus agency and partner resources.

Designing an effective adaptive management system involves the following key steps:

- Determine what management questions will be appropriate for consideration.
- Review management questions to determine potential data collection needs.
- Stratify management questions based on the intensity of data collection required and its application in NFS business processes.

Management questions, which include environmental issues, monitoring questions, and management concerns, are organized into groups derived from the themes and sub-themes used in the Forest Service Monitoring and Evaluation Framework (USFS 2007)(Table 2). When appropriate, the standardized outline can include additional sub-themes within each Theme or subdivisions within a Sub-theme. Themes and sub-themes can also be collapsed into more generalized categories.

The organization used within the Monitoring Evaluation Framework allows individual NFS administrative units to select appropriate national protocols to address their local management requirements and questions. Many management questions span jurisdictional boundaries. The ability to organize data and conduct analyses across administrative boundaries is facilitated by using a common framework. This is especially helpful as issues evolve over time and migrate across the landscape.

A more detailed evaluation of the relationships between management questions and the themes/sub-themes will be conducted as part of the business requirements analysis. However, it is apparent from preliminary analysis that several sub-themes may be collapsed into more general groupings.

Table 2 – Monitoring and evaluation framework components

<i>Theme 1: Conservation of Biological Diversity</i>
Vegetation Diversity
Species Diversity
<i>Theme 2: Maintenance of Land Health and Vitality</i>
Invasive Species
Resilience to Wildland Fire Disturbance
Native Insects and Pathogens
<i>Theme 3: Conservation and Maintenance of Soil, Water, and Air Resources</i>
Watershed Health
<i>Theme 4: Maintenance and Enhancement of Social Benefits</i>
Diversity of Opportunities and Settings
<i>Theme 5: Maintenance and Enhancement of Economic Benefits</i>
Provision of Goods and Services
<i>Theme 6: Infrastructure Capacity</i>
Roads and Trails

Evaluation and Assessment

An important consideration in developing inventory and monitoring protocols is an examination of the primary tools or methods for evaluating the data collected to address business requirements. An examination of primary evaluation tools is important to ensure that data inputs necessary to “drive” models are being collected as part of the overall program or are readily available from other sources. This examination also assists managers’ understanding of the nature of the information developed and report on the success of adaptive management programs.

In general, very few management questions are addressed directly by data collected in the field. Often multiple measurements and observations over time are required to develop trend or baseline information. In some instances, data sets from other inventory programs may be added to develop correlations and/or investigate cause-effect relationships.

Cause-and-effect relationships are much more difficult to determine and require a structured (research or administrative) investigation to isolate causal factors. Monitoring data provides limited information for determining cause-and-effect relationships. However, monitoring can serve as an indicator of the need to invest in these more detailed, expensive investigations.

Classification systems, models and analysis tools used within the Forest Service or documented and maintained by other organizations is preferred over the development of new analysis tools and methods. Using existing products results in lower analysis costs and provides the ability to rely upon documentation and reviews associated with published/adopted methods.

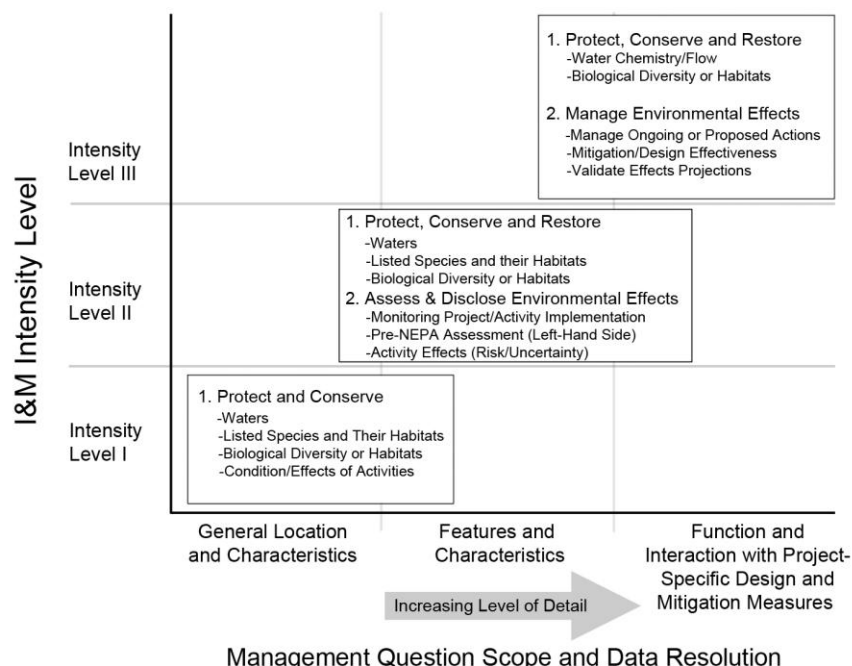
Relationship between Business Requirements & Intensity Levels

It is essential to develop a protocol “package” consisting of integrated modules or components that can be matched to local NFS business requirements. To provide this flexibility and ensure appropriate use of the resulting protocols, the relationship between business requirements (why data are collected) and inventory and monitoring protocols (how data are collected) must be clearly described. In addition, an understanding of how data are analyzed and evaluated to address management requirements and questions is necessary to assure associated costs and required skills are recognized in program formulation and development of cost estimates.

At different decision scales there are relationships between management requirements and questions and the data needed to address those questions. The amount of effort or intensity of inventory and monitoring is often dependent on the decision scale.

There are also logistical reasons for the use of inventory and monitoring intensity levels or scales to organize protocols. Available time and skills may limit a unit’s ability to conduct inventories of specific resources. By providing a variety of inventory and monitoring intensity levels, individual units can make determinations on the extent of resource inventories and adjust the scope and resolution of data collected.

It is also common for NFS managers and specialists to focus on the field data collection activities associated with protocol implementation. This narrow focus often ignores a significant amount of work including the need for specialized skills to facilitate data analysis and evaluation. For this reason, a common template is used to describe the business requirements, data elements or indicators and the inventory procedures used for each intensity level. Again, the purpose of this documentation is to provide for regional and local augmentation of national protocols in response to localized business requirements. The relationship between business requirements and resource inventory and monitoring intensity levels and scales is illustrated in Figure 3.



The number of management questions and the level of detail needed to address those increases with inventory and monitoring intensity. Specific management questions will be identified and associated with business requirements as part of the analysis. Each of the boxes on this diagram represents a grouping of management requirements. The level of detail and resolution for data elements needed to support the business requirements increases from Level I to Level III. For example, the types of information collected in Level I for vegetation would be more general than those collected for Level III.

Defining Resource Types

Often times, there is no consistent set of definitions or classification system within the Forest Service for a specific resource. Different classification systems and definitions can be used by organizations in response to their particular mission or focus. Examples of organizations include the Federal Geographic Data Committee's (FGDC) Classification, the FGDC's National Vegetation Classification Standard, Version 2 (FGDC-STD-005, FGDC 2008), or the National Research Council.

Methods for identifying and defining specific resources must be described and correlated with other Forest Service ecological classification systems. These classification systems may include the hierarchy of terrestrial ecological inventory units used in EcoMap (Cleland et al. 1997), the hierarchy in the Existing Vegetation Classification, Mapping and Inventory Technical Guide (GTR-WO-67), and the hierarchy of aquatic ecological inventory units (Maxwell et al. 1994). These mapping systems conform to standards adopted by the Federal Geographic Data Committee.

Sampling protocols are developed to improve efficiency. Protocols recognize practical considerations regarding inventory and monitoring of specific resource features. In some instances, the appropriate method for data collection must be selected by a field crew upon visiting a site. This requires alignment of basic data collected at different inventory levels between protocols, including protocols for unrelated resources.

To facilitate a practical, efficient approach, the resource data will need to use definitions and standards adopted by the Forest Service. Existing vegetation types and classes used in resource protocols will be consistent with Forest Service standards for mid-scale vegetation (Brohman and Bryant 2005).

Summary

In summary, a thorough evaluation of business requirements for resource protocols establishes a sustainable and flexible inventory and monitoring system that:

1. Provides high quality data to support decision making;
2. Acquires data needed to address priority management questions; and
3. Provides data necessary for key agency assessment and evaluation needs.

With this foundation the Forest Service and its partners will be in a better position to use adaptive management approaches to address current and future management issues affecting our nation's ecosystems.

Appendix B – Information Management Concepts

Information management is a structured process to bring quality information in the right form to the right people at the right time to support sound and deliberate decisions and to generate ideas (U.S. Forest Service, 1992). For information to best support the mission and business of the organization, information management must be driven by Forest Service strategic goals and business requirements. As a result, it is important to define business needs or requirements that support the purpose of collecting data in the field, definition of data standards, development of methods or protocols for data collection, storage of data in accessible data systems, quality control and assurance, information security, and management of the information system over time.

Business Requirements Analysis

A structured inquiry is essential in identifying and evaluating business requirements. A detailed review of management requirements and management questions addressed provides both transparency and the ability to reexamine requirements being addressed and their priorities over time.

Business requirements originate from laws, regulations and policy as well as management issues and concerns. Once business requirements are documented and understood the next phase of the analysis is determining management's priorities for addressing these requirements and then evaluating how data collected will be used to address questions.

At this stage in the process it becomes possible to identify inventory and monitoring methods best suited to gather the data needed to address priority business requirements. Data storage and analysis are also supported by the business requirements analysis.

Over time business requirements and priorities are expected to change. A structured business requirements analysis is needed to provide a benchmark for evaluating the effects of changing requirements.

Basic Data Collection vs. Interpreted Data

Information needed to support decision making takes many forms. **Basic data** consists of "raw" data collected in the field that has not been processed or interpreted. This data provides the foundation for a variety of interpretations and persists over time. **Interpreted data**, although valuable, is often developed for specific purposes, cannot be transferred to other users, and may not persist overtime. Information management systems must focus on the storage of basic data to provide long-term utility.

Data Standardization

To ensure the compatibility and utility of information across the agency we need consistent **data standards** and **protocols** that support agency business needs. This provides data that can be used multiple times for multiple purposes.

Business Requirements Analysis

Existing Vegetation Classification, Mapping, and Inventory

Common standards facilitate data sharing. Future threats to the nation's forests and rangelands in a multi-jurisdictional environment will challenge partners to be consistent. Data standards are often set by other entities, for example the Federal Geographic Data Committee and agencies with government-wide responsibilities assigned by Statue or Executive Order.

As geographic information systems have matured and become the principle method of analyzing and assessing data, geospatial location has become an essential component of our data standards that increases the utility of data within an information management system.

Standardization Increases Utility

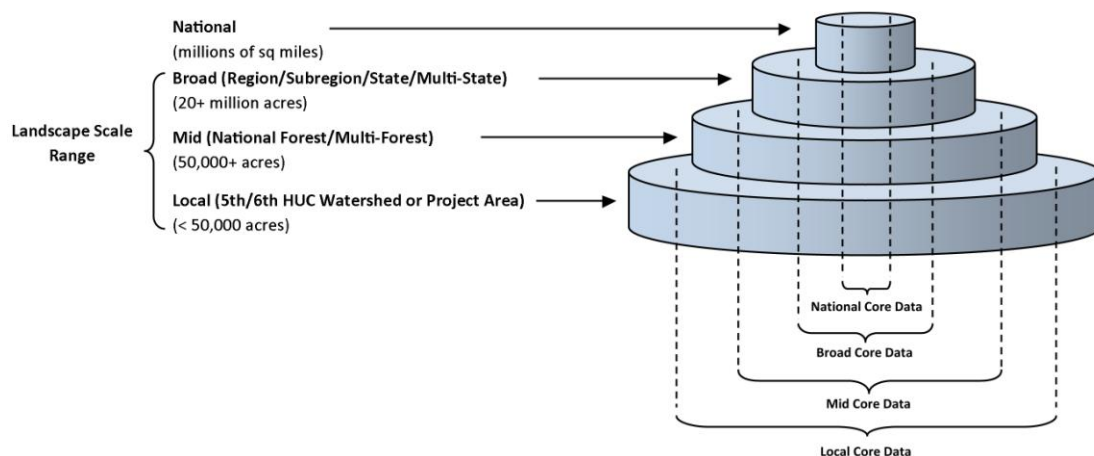
There are numerous examples we take for granted every day that are the product of standardization. The impetus for these standards often had its roots in the need to integrate across organizations and various mission areas. Notable examples include railroad "gauges", fire hose fittings, and ammunition standards used by NATO forces. All aimed at one goal; increase the ability to integrate different organizations around common goals or efforts.

Core Data Concepts

The more fundamental the data (inventory, personnel records, business processes) the larger the proportion of standardized and shared information. Conversely, more specialized, interpretive, or external information systems have less standardized, shared information. Beyond the standardized, shared information, each data system would continue to have flexibility for other data needs. Data standardization within this context is often referred to as **core data or variables** and is often represented in the following diagram:

Multilevel Integration – Core Business Requirements, Management Questions, and Supporting Information (Data)

Organizational Level (Geographic Scale)



Change Management

Information systems must adapt to changing business requirements and technology. To sustain an information system, a defined change management process that considers business requirements, management priorities, the results of research and development is essential.

A change management system must provide order and organization to requests for improvement and for problem resolution encountered during deployment. Without an established system, the governance body cannot establish a version control process and manage the system – in its absence

these pressures begin to fragment the system and competing views and interests will dominate the future. Elements of a change management system include:

Governance - A clearly defined and established governance group is required. The GDE Inventory and Monitoring Protocol Development Charter established an organization to serve this purpose. Following protocol development, the Steering Team and Core Team will need to transition to longer term roles associated with governance of the change management process.

Data Stewardship/Quality Control and Assurance - Data stewardship is a vital part of the system's QA/QC process and necessary to meet the requirements of the Data Quality Act. A network of data stewards that includes all organization levels is essential to linking locally derived and verified data and national data sets. This role is necessary to maintain alignment between administrative unit level data and national data as well as between system components.

An integrated change management system informs the executive governance group in two primary arenas:

Version Control – This is the process of making fundamental changes in the information system. Versions typically change when the underlying computing infrastructure or primary program language change, data distribution systems are updated, or a fundamental approach to modeling or computing fire behavior, as an example, affects the system. These changes are usually the result of basic research and development work. Versions are typically labeled in the following fashion – v1.0 or v2.0.

Updates – This is the process of incorporating corrections or updates to a component of the system. In most instances user requests are the source of most updates and are initiated to support those needs. Updates are typically labeled as – v1.3 or v2.5.

In practice a routine evaluation of user requests generated from a help desk or other input source coupled with an evaluation of innovations and improvements resulting from research and development are evaluated. The executive oversight group's decision to change versions or initiate an update involves looking at the synchronization of changes across all components and considers the schedule for release.

Appendix C – Authors and Contributors

Authors

Linda Ann Spencer, Natural Resource Manager (NRM), Vegetation Ecologist. WO Detached. Juneau, AK was primary author and facilitated the business requirements analysis.

Stephen J. Solem, Senior Advisor for Natural Resource Planning and Inventory and consultant to METI, Inc., Missoula, MT was primary author and facilitated the business requirements analysis.

Kellen N. Nelson, Inventory and Monitoring Specialist, METI, Inc. Fort Collins, Colorado compiled business requirements presented in Section 2.

Julie A. Woldow, Communication Specialist, METI, Inc. Anchorage, AK provided editorial review of the draft document.

Luke A. Boehenke, Graphics Specialist, METI, Inc., Chicago, IL developed or revised graphics and figures presented in the final draft.

Contributors

Members of the Existing Vegetation Technical Guide development team provided review and comment on draft versions of the document. A full listing of team members can be found at: <http://www.fs.fed.us/emc/rig/protocols/vegclassmapinv.shtml>