



inventory

monitoring

assessment

Inventory, Monitoring, and Assessment Strategy

USDA Forest Service

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Executive Summary

Sound stewardship of natural resources and related social and economic values requires high-quality information about resource conditions, trends, stressors, and the impacts of land use and land management activities at multiple scales and across ownerships. Inventory, monitoring, and assessment (IMA) activities are primary sources of this information. Despite decades of hard work and many notable accomplishments, the Forest Service lacks a strategic, comprehensive approach for conducting IMA activities that responds to the priority business requirements of the agency. Current IMA activities do not enable the Forest Service, along with its partners and stakeholders, to answer many critical management questions at the field level and generally do not allow aggregation of data to answer many national and regional questions.

Two critical issues related to current IMA programs and activities are (1) the failure to appropriately align and integrate priority business requirements and core information needs, and (2) the lack of consistent, transparent governance. This results in unconnected decisions and inefficiencies in program delivery. The task now is to further align and integrate IMA activities, prepare for the IMA needs of the future, and make appropriate investments in IMA activities to achieve efficiencies and be as cost-effective as possible as we collaborate with our land management partners.

This strategy focuses on what the Forest Service can do within its own authorities and capabilities to improve IMA activities and more effectively collaborate with partners in pursuing common land and resource management challenges. It presents goals, objectives, and strategic improvements that will lead to improved effectiveness and efficiency. The strategy was developed based on extensive outreach and feedback from within the agency and from land management partners and builds on decades of agency experience in managing IMA activities.

The goals and objectives for the Forest Service IMA system are:

Goal 1: Support effective decision-making by providing relevant and credible information.

Objective 1: Focus IMA efforts on priority management questions and related core information.

Objective 2: Improve the integration and scalability of IMA information.

Objective 3: Ensure information is based on relevant science.

Objective 4: Ensure quality and consistency of information.

Objective 5: Ensure information is timely and accessible.

Goal 2: Ensure that all IMA activities are inclusive and comprehensive.

Objective 1: Understand partner and stakeholder interests and address shared information needs.

Objective 2: Ensure IMA activities address issues across organizational and geographic boundaries.

Goal 3: Ensure the IMA system is responsive and adaptive to change.

Objective 1: Establish and maintain a dynamic IMA system that supports management and is responsive to social, economic, and ecological change.

Objective 2: Ensure the IMA system is responsive and adaptive to changing agency capacity.

The Forest Service intends to take a systematic approach to managing IMA activities and to working across boundaries with partners and stakeholders to generate and maintain the information necessary for land management decision-making. Implementation of the strategic improvements and actions identified in this strategy will be done in phases. The initial phase will address the high priority actions described below while work continues on important IMA activities already underway, such as establishing an IMA Web portal and developing IMA best practices for the agency. Subsequent phases will address other actions over the next few years, many of which will be identified while working through the high-priority actions, sharing best practices, and learning collaboratively with partners.

The agency will begin with three high priority actions to implement this strategy.

1. Identify priority management questions and core information needed for all levels of the agency. Identify opportunities to share information and leverage partner information to meet shared priorities.
2. Clearly define and establish IMA governance roles and responsibilities at all levels of the agency.
3. Develop new and improve existing agency-wide performance and accountability elements for conducting and managing IMA activities.

Introduction

The Forest Service mission is to sustain the health, diversity, and productivity of the Nation's forests and rangelands to meet the needs of present and future generations. As demands for natural resources increase, sound stewardship of these resources and related social and economic values requires increased attention to the information used in critical decision-making. Decision-makers need high-quality information about resource conditions, trends, stressors, and the impacts of land use and land management activities at multiple scales and across government and private ownerships. Inventory, monitoring, and assessment (IMA) activities are primary sources of this information. This Strategy presents broad goals, objectives, and strategic improvements for IMA activities (including assets, products, and services) in the Forest Service.

Scope and Purpose

The scope of this Strategy includes IMA activities across all deputy areas of the Forest Service related to natural resources and associated social and economic systems. It generally does not include such areas as human resource management, fleet management, or acquisitions and finance. The purpose of the strategy is to:

- Design an IMA system for national, broad, mid, and local levels that is properly aligned and integrated to achieve priority work of the agency;
- Ensure consistency of information in time, space, and quality;
- Work with partners to share information and address common needs;
- Develop a structure for IMA governance, performance, and accountability.

Currently, the Forest Service lacks a strategic, comprehensive approach for conducting IMA activities that responds to the priority business requirements of the agency. Instead, agency staffs deliver a mix of IMA products and services that reflect individual or programmatic perceptions of needs. Furthermore, the Forest Service has not been able to effectively manage the volume of resource information needed to keep pace with practitioner demands. The result is that data are often collected inconsistently and are not well integrated spatially or temporally, thus lacking the quality to meet today's needs. Current IMA activities do not enable the Forest Service, partners, and stakeholders to effectively and consistently answer many critical conservation questions at the field level and do not enable aggregation of data to answer many national and regional questions. The Forest Service needs an improved approach for developing and sustaining IMA capabilities and for working with partners to better share information across boundaries.

The need to improve information quality and accessibility across the entire Federal government is widely recognized. In response, the White House issued the [Open Government Directive](#) that requires the heads of executive departments and agencies to take specific actions to implement

the principles of transparency, participation, and collaboration. The IMA Strategy will guide the Forest Service in fulfilling the Directive.

Agency leadership seeks improved efficiencies for IMA activities and assurance that they are making the right investments to meet essential decision-making and management needs. Environmental threats and evolving business requirements, such as climate change vulnerability assessments, watershed and landscape restoration, planning rule requirements for broader scale monitoring and assessments, and interagency reporting requirements, also make it imperative that we improve how we manage IMA activities.

Past Efforts

The Forest Service has invested significant time and money in IMA improvements over the past 20 years. These efforts have made incremental improvements in some aspects of inventory, monitoring, or assessment activities. These gains are the building blocks for this IMA Strategy. Previous efforts are identified in a separate document on the IMA Sharepoint site.

The agency now has corporate data systems that are being aligned to provide products and services across multiple resource areas. Past efforts have provided input to the broader-scale monitoring requirements of the Planning Rule and have set the stage for the many improvements addressed in the Standard Data Management project, including the Forest Service Catalog for datasets, protocols and maps, and data quality evaluation tools. Previous efforts have also shown that all of the IMA problems and issues of the agency cannot be solved immediately or even in a short period of time. The lessons learned are to find the right balance and appropriate sequencing for implementing priority agency strategic improvements and to work with our partners to address common business requirements and information needs.

Current Conditions

Currently, IMA activities supporting decision-making and management of ecological, social, and economic systems occur at all levels of the Forest Service. National forests and grasslands monitor their land management plans for implementation and effectiveness. Resource program managers inventory vegetation, monitor water quality, and assess social and economic systems in localities near national forests and grasslands. Most of these IMA programs and activities are specific to resource area needs. The Research and Development Deputy Area manages the state-of-the-art Forest Inventory and Analysis program in collaboration with state partners. The State and Private Forestry Deputy Area manages the highly valued Forest Health Monitoring Program. Across the country, the Forest Service contributes to broader-scale assessments such as state assessments in support of the 2008 Farm Bill. The Resources Planning Act Assessment and the Southern Forest Futures Resource Assessment are two examples of Forest Service collaboration with partners to deliver critical resource information that addresses management challenges and choices across public and private ownership boundaries.

FIG. 1 COLLABORATIVE RESOURCE ASSESSMENTS — THE SOUTHERN FOREST FUTURES PROJECT

The Southern Forest Futures Project (SFFP) has been a successful collaboration among key partners and stakeholders. It was chartered by the USDA Forest Service's Southern Region, the Forest Service's Southern Research Station, and the Southern Group of State Foresters and had extensive public input.

National, regional, and local scale resource assessments are useful for evaluating the implications of potential futures for the many goods and services forests provide. Like other regions throughout the United States, regional scale resource assessments in the South are challenging because of the broad diversity of ecological systems, economic conditions, land ownership patterns, and social settings. The overall goal of the SFFP is to inform land management strategies, policy discussions, and program decisions with the clearest understanding of the potential long-term implications of changes to forests in the 13 southern states. Resource assessments like the SFFP are comprehensive and relevant on many levels and for diverse purposes including land management planning.

Much of the knowledge base relevant to forests is ecosystem-specific; so the assessment uses a three-tier approach to address the simultaneous needs for a coherent regional outlook on forest futures and a detailed analysis of ecological, economic, and social effects.

Because the SFFP addresses a broad complement of issues affecting the decisions of forest managers, policymakers, science leaders, and the interested public, extensive public input was sought on the specific issues to be addressed. Public input was integral to the formulation of specific plans for all tiers of analysis. For the forecasting work, public input helped shape the scenarios analyzed using technical models. In addition, public input was used to define and describe the sets of regional assessment questions. For the sub-regional analysis, input was sought on the potential ecosystem and local economic impacts of future changes and the values at risk within each of the sub-regions.

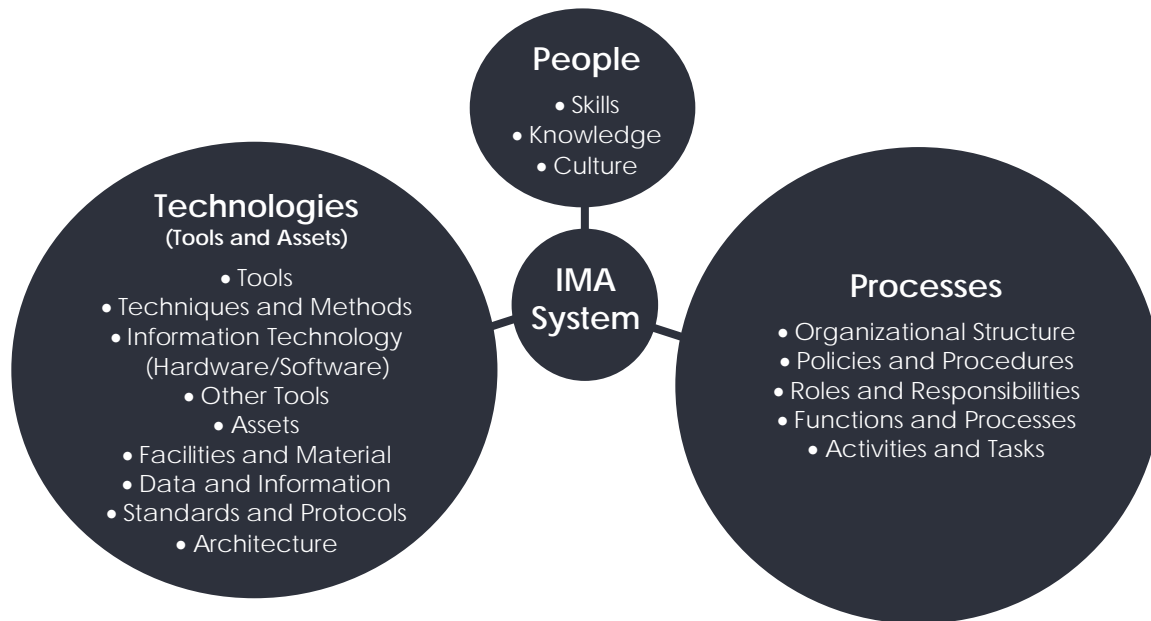
Despite decades of hard work and many notable accomplishments, the Forest Service lacks a strategic, comprehensive approach for aligning and integrating IMA activities across resource areas. The most cross-cutting issues related to current IMA programs and activities are: (1) a lack of consistency and (2) no coordinated approach to governance and decision-making. Data collected or stored on a district or forest may not be consistent over time or may not be collected using the same protocols as neighboring units. Spatially and temporally consistent data may not be gathered using a statistically valid sampling design, when needed, or with appropriate attention to data quality. Programs may not take full advantage of the information that partners can offer or design IMA activities to meet multiple needs. Thus, not all IMA products and services achieve a high level of utility, effectiveness, and efficiency. These problems are widespread and

affect the agency's ability to answer critical questions. The Forest Service can no longer afford to invest broadly in IMA activities that meet discrete needs without contributing to broader uses and applications.

The Forest Service must develop a systematic approach to identifying, prioritizing and conducting IMA activities, while recognizing forests and rangelands as ecosystems that, regardless of ownership, are affected by many common environmental stressors, resource conditions, and societal issues. There must be an explicit connection between land management decisions—whether made by us or by our land management partners—and the information gathered to inform those decisions. As institutional resources fluctuate, the agency will have to prioritize information needs at local, regional, and national levels.

FIG. 2 IMA System

An IMA system integrates resource information in support of agency land management decision making. Some system elements relate to people—the collective skills, knowledge, and culture of Forest Service employees and partners, who are both the users and the providers of IMA products and services. Some elements relate to processes—the policy, functions, and business activities of the Forest Service and partners, used to identify information needs, inform decision making, and perform work activities. Other elements, such as technologies: 1) Tools (i.e., techniques, methods, information technology) and 2) Assets (i.e., facilities, material, information, standards, protocols) support people as they execute business processes. Through integration, alignment and communication, the Forest Service transitions IMA from a mix of uncoordinated activities to a more unified, comprehensive system.



Desired Characteristics

The Forest Service intends to integrate and build upon existing IMA programs to move from a collection of IMA activities to an integrated, efficient IMA system. Desired characteristics of an IMA system are:

1. Improved clarity and understanding of agency IMA priorities, policies, direction, decision-making processes, and roles and responsibilities, with IMA investments appropriately aligned and integrated to achieve the agency's priority work.
2. Consistency and comparability of information for use at multiple scales, across multiple units and landownerships, and for multiple resource areas.
3. A perspective that extends beyond the boundaries of National Forest System lands to meet information needs shared with our public and private partners.
4. Improved understanding of natural resource conditions at national, broad, mid, and base (local) levels as they relate to sustainability and public benefits and to the management actions that secure them.

Strategy Development

Agency leadership is fully committed to the success of this effort. The Steering Committee guiding the effort is an interagency group of leaders from the Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Geological Survey, and National Association of State Foresters. The Core Team developing the Strategy includes Forest Service staff from the National Forest System, Research and Development, State and Private Forestry, and Business Operations. A collaborative process was used to develop the goals, objectives, and strategic improvements of this IMA Strategy. Content of the IMA Strategy is based on input from employees and partners during sensing interviews, meetings, and feedback sessions in 2011 and 2012 (See Appendix 1).

To assist in developing this Strategy, the Forest Service initiated five resource-specific case studies focused on: (1) critical loads of air pollution, (2) aquatics inventory and monitoring, (3) carbon assessment and management, (4) vegetation status and trends, and (5) land management plan broader-scale monitoring (see Appendix 2). For each case study, work groups described the current situation and desired conditions for elements of IMA. The final reports documented specific actions needed to achieve the desired improvements for each specific case study. They highlighted the need for coordination with internal and external partners and some of the costs and benefits of implementing the proposed changes. Many of the strategic improvements identified in this Strategy came from these case studies. For example, the land management plan broader-scale monitoring case study identified the need for easier and more frequent sharing of information and tools between and among the Forest Service, partners, and stakeholders and for expanded technology transfer and synthesis of research. Other

recommendations from these case studies will be considered as potential implementation actions. For example, the carbon and vegetation case studies identified the need to develop and implement national standards and guidelines for vegetation inventory and mapping through revision of the Existing Vegetation Classification, Mapping, and Inventory Technical Guide.

FIG. 3 ESTABLISHING NATIONAL STANDARDS FOR RESOURCE INFORMATION

Many of the management questions and indicators relevant to ecosystem assessment and land management planning at local, regional, and national levels are common across Forest Service regions and planning units. For example, vegetation is the primary natural resource managed by the Forest Service and the agency spends the most money on inventories and assessments of this resource. In the past, consistent standards for classification and mapping of existing vegetation did not exist. This lack of standards limited the agency's ability to share vegetation descriptions and maps across unit boundaries and to frame a wide variety of sustainability topics, including wildlife habitat, water quality and quantity, carbon sequestration and storage, wood products, recreation, and delivery of other ecosystem services and goods.

In 2005, the Forest Service published version 1.0 of the Existing Vegetation Classification and Mapping Technical Guide, a collection of protocols that provides direction related to existing vegetation information. The technical guide provides a standardized vegetation classification system and a consistent framework for cataloguing, describing, mapping, and communicating information about existing plant communities.

The Forest Service is completing the first revision of this technical guide, which will ensure consistency with classification standards set by the Federal Geographic Data Committee and used by all Federal agencies. The revised version will also include a new section on integrating vegetation inventories to achieve greater efficiency and cost savings. In keeping with the intent of the IMA Strategy and providing the best available scientific information, partners and technical specialists from many agencies and organizations will be invited to participate in the review process for the revised Existing Vegetation Classification, Mapping, and Inventory Technical Guide.

The task now is to further align and integrate IMA activities, prepare for the information needs of the future, and make appropriate investments in IMA activities to better inform decision makers while achieving efficiencies. The Forest Service will continue to look within and beyond the agency to understand needs, opportunities, resources, and constraints to improving IMA activities. This Strategy focuses on what the Forest Service can do within its own authorities and capabilities to improve IMA activities and more effectively collaborate with partners in pursuing common land and resource management challenges.

Vision

Land managers have the natural resource information they need to collaboratively manage forests and rangelands.

To accomplish this vision, the Forest Service needs to:

- Align IMA activities into a cohesive effort for local, regional, and national decision-making;
- Deliver highly credible information and assessments that meet shared objectives with land management partners; and
- Be adaptable to meet evolving business requirements.

Goals, Objectives, and Strategic Improvements

Goal 1: Support effective decision-making by providing relevant and credible information.

An effective IMA system requires relevant, accurate and credible information to make sound land management decisions. This information should be business driven, science-based, trusted and readily accessible. Forest and grassland ecosystems are expected to provide a sustainable supply of services, products, and experiences that contribute to the quality of life for current and future generations. The IMA system supports this goal by providing the resource data, analysis, and tools to make well-informed, effective management decisions for the Nation's forests and rangelands.

Objective 1: Focus IMA efforts on priority management questions and related core information.

The Forest Service will engage all levels of the agency and partners to identify priority management questions associated with corporate business requirements and will focus our efforts on identifying, acquiring, maintaining, using and sharing core information.

Strategic improvements include:

- a. Established architecture for governance and decision-making to identify priority management questions and related core information.
- b. Increased alignment of IMA activities with agency priorities.

Objective 2: Improve the integration and scalability of IMA information.

Decision-makers need high-quality information about resource conditions, trends, stressors, and the impacts of land use and land management activities at multiple temporal and spatial scales across ownerships.

Strategic Improvements include:

- a. Development and use of a standards-based approach and organizing framework for management of IMA activities.
- b. Enhanced coordination of IMA activities across resources and programs
- c. Established policy and direction, standards and methods, processes and guidelines for IMA information and data.

Objective 3: Ensure information is based on relevant science.

IMA activities should provide accurate, reliable, and relevant scientific information. This requires a two-way flow of information between scientists and land managers to work together to align management questions and core information needs with scientific methods and tools. A sound problem-framing process will strengthen partnerships between management and scientists.

Strategic improvements include:

- a. Increased communication between scientists and managers (including a broad array of clients and partners) to ensure common awareness of current information needs and relevant science.
- b. Use of processes that engage scientists and managers in understanding the management problem, framing the question(s), and designing the inventory, monitoring, assessment, and information delivery procedures.

Objective 4: Ensure quality and consistency of information.

Data acquired through IMA activities provide the analytical basis for decisions. Therefore, high quality data are vital to effective and defensible land management decisions and policies. Given the scope of IMA activities, the Forest Service needs to efficiently gather and use information for decisions at multiple scales and in cooperation with others where appropriate.

Strategic improvements include:

- a. Consistent use of statistically valid and efficient inventory and monitoring sampling designs appropriate to the management questions being addressed.
- b. Development and use of appropriate standards, protocols, and technology for data acquisition, analysis, and other IMA activities.

- c. Development and maintenance of a comprehensive information quality assurance and quality control program.
- d. Greater awareness of and use by managers of methodologies, tools, and applications that have undergone a thorough review process to ensure quality, scientific rigor, feasibility, and effective applicability.

Objective 5: Ensure information is timely and accessible.

Quality data are of greatest value when readily available to land managers. The Forest Service will provide timely, transparent, and accessible information as well as the technologies, protocols, and tools to effectively use information in decision-making and management activities.

Strategic improvements include:

- a. Increased standardization in sharing information internally, with partners, and with the public.
- b. Expanded use of web sites to provide information, data, metadata, analytical tools, and commonly requested products in a timely manner.
- c. Timely delivery of technologies and research results.
- d. Improved linkage and functionality of protocol and tool enhancements with legacy or existing data and metadata to ensure its continued use.
- e. Increased awareness and ability to share IMA data, metadata, tools, and models.

Goal 2: Ensure that all IMA activities are inclusive and comprehensive.

Many of today's management decisions require a landscape approach to acquiring and analyzing information about forests and rangelands. Therefore, an effective IMA system requires working across organizational boundaries to determine common goals, avoid duplication, and build on common information needs. The Forest Service will promote a collaborative approach to provide essential information to land and resource managers.

IMA activities should consider business requirements and information needs beyond administrative boundaries, and where appropriate, reflect the varied perspectives of our land and resource management partners and stakeholders.

Objective 1: Understand partner and stakeholder interests and address shared information needs.

An effective response to land management issues starts with understanding the interests of the Forest Service and our partners and stakeholders, articulating high-priority, well-framed management questions, and identifying their information needs. The Forest Service will enhance its outreach and communication with partners and stakeholders to identify common interests and shared information needs relevant for effective decision-making.

Strategic improvements include:

- a. Participation in IMA communities of practice to understand common interests and shared information needs.
- b. Expanded participation by the Forest Service with other land management partners in the coordination of joint IMA activities.
- c. Greater agency capacity to develop and sustain partnerships for improved efficiency and effectiveness.
- d. Easier and more frequent sharing of relevant information to address common interests.

Objective 2: Ensure IMA activities address issues across organizational and geographic boundaries.

Critical land management issues (e.g. forest health, invasive species, soil quality, fire and fuels, water quantity and quality, and wildlife habitat connectivity) transcend administrative boundaries and often require a collaborative approach to achieve successful management outcomes. The Forest Service will expand collaborative efforts to devise and implement IMA activities that leverage relevant information where appropriate.

Strategic improvements include:

- a. Greater capacity to leverage existing partner information and address common information needs.
- b. More frequent collaboration to conduct IMA activities when issues or information needs cross organizational boundaries.

Goal 3: Ensure the IMA system is responsive and adaptive to change.

The IMA system should be capable of monitoring and projecting changes in ecological, social, and economic conditions and be capable of accommodating changes in institutional capacity.

The IMA system must be able to provide core information at all levels and scales, including information on the status and trends of resource conditions. This will assist land and resource managers in providing needed goods and services in a changing physical and social environment. Likewise, the system should be able to accommodate new information sources. Successful management of the IMA system requires skilled staff, adequate resources, and well-functioning governance to enable the course-correcting actions needed to adjust to these changing conditions.

Objective 1: Develop and maintain an IMA system that is dynamic, supports management, and is responsive to social, economic, and ecological change.

Rapid changes in social, economic, and ecological conditions have resulted in land managers becoming reactive rather than proactive. By its very nature, land management requires looking

decades into the future. Therefore, we must have accurate and consistent historical data in order to make projections. It is imperative that the IMA system effectively supports such analyses.

Strategic improvements will allow for:

- a. Increased ability of land and resource managers to recognize changes in conditions that warrant new management questions and core information needs.
- b. Increased ability to monitor implementation and effectiveness of land management strategies.
- c. Increased ability to provide information to meet evolving needs

Objective 2: Ensure the IMA system is responsive and adaptive to changing agency capacity.

The Forest Service will focus and leverage resources to meet current and evolving information needs. The IMA system must be able to respond and adapt to changes in agency capacity, especially when capacity is reduced. More efficient and targeted work will focus investments on critical management questions and core information at local to national levels. As funds and staffing continue to decrease, we are being forced to do “less with less” while being mindful that we are performing critical work.

Strategic improvements include:

- a. Increased focus on investments that address priority management questions and provide core information.
- b. Greater leveraging and sharing of resources with partners.
- c. Improved staffing and resources to meet Forest Service information needs and those commonly shared with partners.
- d. Improved corporate information technologies that meet current and evolving requirements for IMA activities.

Strategy Implementation

The strategic improvements and actions identified in this strategy will be implemented in phases. The initial phase will address the high priority actions described below while continuing to work on important IMA activities already underway. Examples of essential ongoing work include participating in specific IMA mission-related activities with Federal and State partners (e.g., Forest Inventory and Analysis, Rapid Ecosystem Assessments); completing and releasing search and catalog tools for Forest Service protocols and datasets (e.g., Standard Data Management, Enterprise Data Warehouse, GSTC Mapping Services); establishing an IMA Web portal; and developing IMA best practices for the agency. Subsequent phases will address additional follow-up actions to address remaining strategic improvements.

High Priority Actions

The following actions will be undertaken to achieve the strategic improvements of highest priority:

1. Identify priority management questions and core information needed for all levels of the agency. This requires establishing an organizing framework and identifying opportunities to share information among partners. Results will assist in identifying needed changes to other elements for managing IMA activities.
2. Clearly define and establish IMA governance roles and responsibilities at all levels of the agency. Governance must be in place to effectively guide implementation of the IMA Strategy and manage IMA activities over time.
3. Develop new and improve existing agency-wide performance and accountability elements for conducting and managing IMA activities. Indicators, measures, and reporting tools (e.g., an IMA scorecard) need to be established to evaluate the degree to which IMA implementation actions are completed, tracking the use of best management practices, establishing IMA targets and reporting IMA accomplishments.

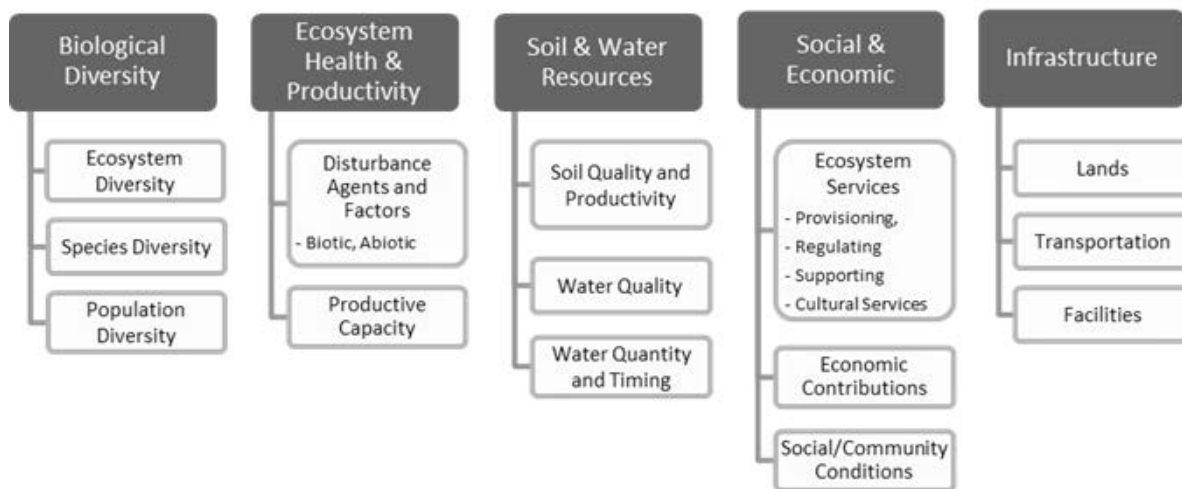
As we implement the high priority actions, we will continue to coordinate and communicate with partners to ensure the developing system will meet shared information needs.

FIG. 4 THE NEED FOR AN IMA ORGANIZING FRAMEWORK

The IMA system (see earlier sidebar) reflects essential resource and information management activities that address the diversity of business requirements facing the agency. The overwhelming quantity and types of information available from other agencies, partners, and stakeholders adds to the complexity inherent in this system. It also makes it imperative that a comprehensive framework be established for acquiring, managing and using this information to support sustainable management of land and natural resources.

The starting point for organizing resource information is to identify the agency’s key land and resource management questions that are tied to its mission. A unified, multi-scale organizing framework will help focus and categorize these questions and will facilitate collaborative development of management questions in common across FS staffs and with key partners and stakeholders.

The diagram below illustrates an initial organizing framework for IMA whose design is based on the Montreal Process Criteria and Indicators, the Forest Service Monitoring and Evaluation Framework (subsequently improved by the Northern Region), and other environmental indicators and measures that represent a spectrum of land and resource management information needs. A common organizing framework adopted by Federal, State, Tribal, international, and other key partners could serve as the foundational architecture of an integrated information system.



Glossary

Assessment. An analysis and interpretation of the social, economic, or ecological characteristics of an area using scientific principles to describe existing conditions, trends, or projections as they affect sustainability. Assessments provide the foundation of independent information upon which to build conservation strategies and management decisions, and against which alternative approaches can be evaluated and modified (USDA Forest Service 2009a).

Business requirement. A corporate (whole agency or partnership) need identified as necessary for successful achievement of goals or objectives (including strategic, tactical, legal, or operational objectives). Business requirements may be represented in a variety of contexts and are most often defined in response to establishing requirements for processes, compliance to business direction, and identification of information technology functionality requirements (USDA Forest Service 2009a).

Broader-scale monitoring. Monitoring related to questions that can best be answered at a geographic scale broader than one planning unit (USDA Forest Service 2011).

Collaboration. People working together to share knowledge and resources to describe and achieve desired conditions for land management and associated social, ecological, and economic systems. Collaboration applies throughout land management, encompasses a wide range of external and internal relationships, and entails formal and informal processes (USDA Forest Service 2009a).

Community of practice. A formal or informal network or association of professionals who share common concerns, issues, problems, mandates, or sense of purpose. It is also a group of professionals informally bound to one another through exposure to a common class of problems, common pursuit of solutions, and thereby themselves embodying a store of knowledge (USDA Forest Service 2010).

Core data. The essential set of data needed to answer the priority management questions, collected using standard protocols.

Evaluation. An appraisal and study of social, economic, and ecological conditions and trends relevant to a unit. The analysis of monitoring data that produces information needed to answer specific monitoring questions. Evaluation may include comparing monitoring results with a predetermined guideline or expected norm that may lead to recommendations for changes in management, a land management plan, or monitoring plan. Evaluations provide an updated compilation of information for use in environmental analysis of future project and activity decisions (USDA Forest Service 2009a).

Governance. The act, process, or exercise of authority and control including the persons who make up a governing body to administer such actions (USDA Forest Service 2012a). A structure of authority established to make decisions, allocate resources, and coordinate activities related to inventory, monitoring, and assessment.

Information management. The process by which an organization efficiently plans, collects, organizes, uses, controls, disseminates, and disposes of its inventory, monitoring, and assessment information, and through which it ensures that the value of that information is identified and exploited to the fullest extent (USDA Forest Service 2009a).

Inventory. (1) To survey an area or entity for determination of such data as contents, condition, or value, for specific purposes such as planning, evaluation, or management. An inventory activity may include an information needs assessment; planning and scheduling; data collection, classification, mapping, data entry, storage and maintenance; product development; evaluation; and reporting phases (USDA Forest Service 2009a). (2) The systematic acquisition, analysis, and organization of resource information needed for planning and implementing land management (Brohman and Bryant 2005, USDA NRCS 1997). (3) A set of objective sampling methods designed to quantify the spatial distribution, composition, and rates of change of forest parameters within specified levels of precision for the purposes of management (Helms 1998).

Landscape. (1) A spatial mosaic of terrestrial and aquatic ecosystems, landforms, and plant communities across a defined area irrespective of ownership or other artificial boundaries (USDA Forest Service 2011, Helms 1998). (2) Large regional units of land that are viewed as a mosaic of communities irrespective of political or other artificial boundaries (Society of American Foresters 1991).

Management questions. See Priority management questions.

Monitoring. The collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a resource or management objective. A monitoring activity may include an information needs assessment; planning and scheduling; data collection, classification, mapping, data entry, storage and maintenance; product development; evaluation; and reporting phases (USDA Forest Service 2009a).

Partner. Individuals and groups that participate in cooperative, often collaborative relationships with the Forest Service to achieve one or more common goals. Sometimes, it refers to an individual or entity that voluntarily cooperates with the Forest Service on a project and is willing to formalize the relationship by entering into a Memorandum of Understanding or other type of agreement (USDA Forest Service 2009b).

Partnership. A voluntary, mutually beneficial arrangement entered into for the purpose of accomplishing mutually agreed upon objective(s) (USDA Forest Service 2009b).

Performance measures. Indicators, statistics, or metrics used to gauge program performance (USDA Forest Service 2007).

Priority management questions. A select set of questions, based on agency business requirements, that are consistent across the agency. These questions help focus subsequent information needs assessments to identify core data, essential science, and other information.

Information that answers these questions will enable agency decision-making at local, regional, and national levels.

Quality assurance. The total integrated program for ensuring that the uncertainties inherent in inventory and monitoring data are known and do not exceed acceptable magnitudes, within a stated level of confidence. Quality assurance encompasses the plans, specifications, and policies affecting the collection, processing, and reporting of data. It is the system of activities designed to provide officials with independent assurance that quality control is being effectively implemented uniformly throughout the inventory and monitoring programs (USDA Forest Service 2009a).

Quality control. The routine application of prescribed field and office procedures to reduce random and systematic errors and ensure that data are generated within known and acceptable performance limits. Quality control involves use of qualified personnel, reliable equipment and supplies, training of personnel, and strict adherence to service-wide standard operating procedures for tasks such as information needs assessments, establishment of standards and methods, data collection, data processing, classification, mapping, analysis, and dissemination (USDA Forest Service 2009a).

Scorecard. Set of financial and non-financial measurements that indicate the operational effectiveness of an organization (USDA Forest Service 2012a).

Stakeholder. A person, group, organization, or system who affects or can be affected by Forest Service project, policy, or actions (USDA Forest Service 2012b). The Forest Service, including employees, staffs, programs, and other organizational structures, is a stakeholder in these projects, policies, or actions.

Standards-based approach. Established processes for managing inventory, monitoring, and assessment information based upon explicit standards of performance and operation, explicitly standardized tools, and clear standards of success (USDA Forest Service 2009a).

Transparency. As used in science, engineering, business, the humanities, and in a social context more generally, transparency implies openness, communication, and accountability. Transparency is operating in such a way that it is easy for others to see what actions are performed. (Wikipedia).

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Appendix 1 – Results of Sensing Interviews, Meetings, and Feedback Sessions

Issues related to credibility of IMA activities, assets, products, and services

The Forest Service could:

- Be better prepared to assess risk and uncertainty and to determine the adaptive capacity of forest lands to impacts of catastrophic disturbances.
- Have better, more current observations and models to do daily work.
- Better balance and link information with decision-making.
- Evaluate approaches to achieve scalable information.
- Be better able to provide consistent, comparable data from place-to-place, and to compare data for a particular place over time.
- Not collect data without knowing what it is being collected for, or how it will be managed, stored or shared with the public.
- Not design systems in a vacuum; look up, down, and sideways for people who might need the same data. Think “community” when models are developed; think “global.”
- Be sure IMA activities make data accessible and support interpretation, not just collection.

Issues related to inclusivity of IMA activities, assets, products, and services

The Forest Service could:

- Strengthen and leverage information and experience available from all branches of the Agency and non-Forest Service partners.
- Have a more visible, transparent way of decision-making and doing business.
- Ensure the new IMA direction does not overburden regions, forests, and districts.
- Stay connected with users. Someone needs to be in charge of ensuring that questions and data collection continue to meet user needs.
- Look to existing models for gathering data both within and outside the Agency.
- Participate in an inter-agency IMA Community of Practice.
- Cultivate ongoing discussion and a shared understanding of the “all-lands” concept.

Issues related to the responsiveness of IMA activities, assets, products, and services

The Forest Service could:

- Address evolving business and information needs, issues, barriers, and opportunities.
- Maintain and create products and tools that are accessible and usable and are demand/value-driven.
- Move from reactive to proactive for managing risks and impacts.
- Develop indicators and detect triggers that induce landscape changes.
- Make the necessary changes so that resource information is connected with decision-making and, ultimately, influences policy.

Appendix 2 – Recommended Actions from Case Studies

GOAL 1: INCLUDE all lands and all partners

- Provide training and communication tools to increase understanding and effectiveness of broader-scale inventory and monitoring with partners, stakeholders and Tribes. Include collaboration and multi-party monitoring.
- Provide information on our means for providing financial support to other agencies, stakeholders, and Tribes to help plan and collect inventory and monitoring information.
- Create easier mechanisms for sharing funds across agencies and research groups.
- Provide an annotated list of existing inventory monitoring efforts at the national level, acknowledging FS agreements where they exist.

GOAL 2: Provide CREDIBLE information

- Develop a system to objectively prioritize inventory and monitoring activities.
- Develop a list of items/ monitoring areas with standardized protocols that are useful for inventory and monitoring. This may come from existing FS corporate systems, other agency data, or new data sources.
- Identify staffing, training, and budgets scenarios to provide inventory and monitoring expertise in the field and across resource programs.
- Improve coordination of priorities, resources, and procedures across the Agency to facilitate information collection, management, and sharing.
- Create a reporting system for inventory and monitoring in the FS that evaluates progress and accomplishment. Ensure that strategic activities are addressed.

GOAL 3: Effectively RESPOND and adapt

- Identify communication strategies for inventory and monitoring that can weave into existing regional and forest level communication plans.
- Develop a mechanism whereby inventory and monitoring results and recommendations are distributed to all affected resource areas and line officers.
- Share lessons learned and success stories. Consider adopting “ARRA Success Story” approach.
- Improve corporate databases to be more user friendly. Develop clear web-based “how to’s” to obtain and use data systems.
- Develop the ability for the FS to adopt and use externally-created technology and databases.
- Work with S&PF to integrate FIA inventories with other inventories and monitoring across landscapes.
- Integrate existing inventory and broader-scale monitoring programs (FS and non-FS) into datasets for use on local units.

IMA Steering Committee and Core Team

Steering Committee Members:

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Kent Connaughton	Forest Service, Regional Forester of Pacific Northwest Region
Rob Doudrick	Forest Service, Director of Southern Research Station
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