

Chapter 4

Monitoring and Evaluation



Cover photo: Controlled burn on Mark Twain National Forest, USDA Forest Service
Mark Twain National Forest photo on file

Chapter 4

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Introduction

Monitoring and evaluation (M and E) are separate, sequential activities required by National Forest Management Act (NFMA) regulations. Monitoring involves collecting data by observation or measurement. Evaluation involves analyzing and interpreting monitoring data. The information gained from M and E is used to determine how well the desired conditions, goals, objectives, and outcomes of the Forest Plan have been met. Monitoring and evaluation keeps the Forest Plan up-to-date and responsive to changing conditions and issues. This process provides the feedback mechanism for adaptive management (Fig. 4-1). The results are used to identify when changes are needed to either the Forest Plan itself or the way it is implemented.

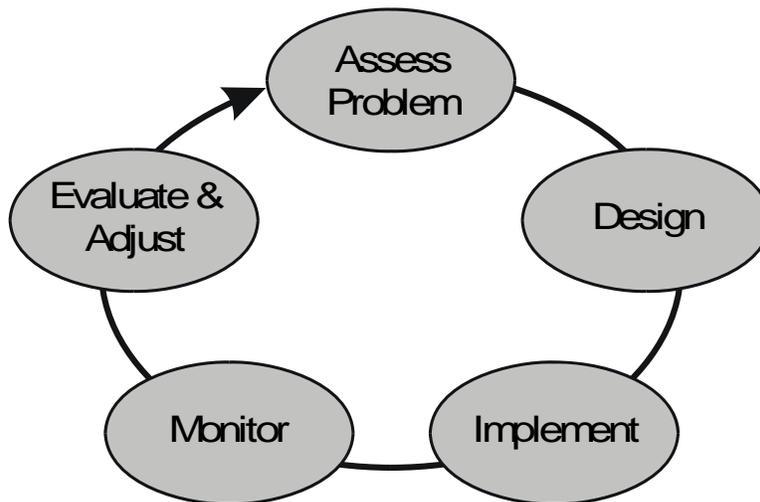


Figure 4-1. Evaluation and monitoring provide the feedback mechanism for adaptive forest management.

Monitoring and evaluation involves more than just collecting and interpreting data. Data must be converted to useful information and stored in a form that is accessible to others. A plan for managing monitoring information over time is critical to a successful program and should be developed early in the planning process. (See Fig. 4-2).

Data will be designed and collected according to appropriate data standards and entered into corporate databases such as Automated Lands Program (ALP), Natural Resource Inventory System (NRIS), or Geographic Information System (GIS). The information can then be accessed and analyzed to produce products such as monitoring reports that would be available for internal and external review (Fig. 4-2, Steps 5 and 6).

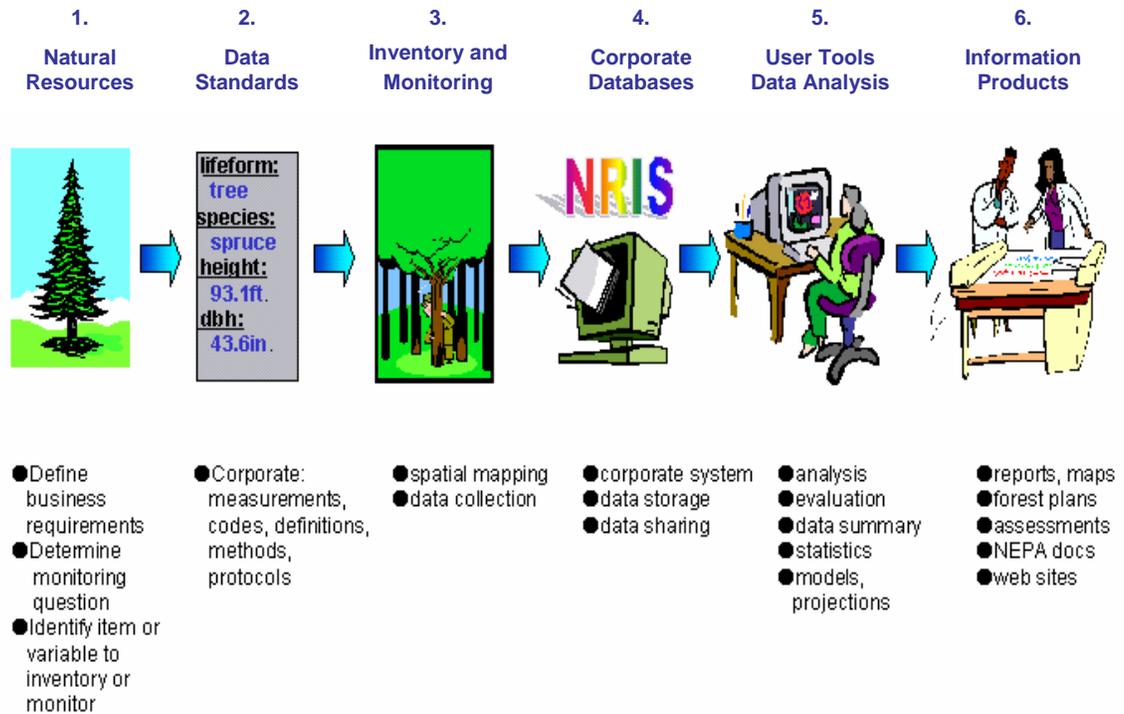


Figure 4-2. Monitoring and evaluation components.

Legal and Regulatory Requirements

The Forest Plan addresses several types of monitoring. These requirements fall into four broad categories:

- Category 1: Required monitoring items (NFMA, and 1982 36 CFR 219 regulations, as permitted by 36 CFR 219.14(e) and (f) of the 2005 Planning rule.)
- Category 2: Attainment of goals and objectives
- Category 3: Implementation of standards and guidelines and
- Category 4: Effects of prescriptions, management practices, and off-road vehicles

Required Category 1 monitoring items (Table 4-1) are mandatory components of every forest plan, whereas Category (2) through (4) monitoring items are more flexible and tailored to address issues raised through public scoping and interdisciplinary team review. A more complete description of Category 1 through 4 monitoring items is shown in the Monitoring Matrix section.

Table 4-1. Required Category 1 monitoring items.

Monitoring Description	Annual Posting of Results?	Five-year Evaluation Report?
Conduct a program of monitoring and evaluation that includes consideration of the effects of National Forest Management on land, resources, and communities adjacent to or near the National Forest being planned and the effects upon National Forest management from activities on nearby lands managed by other Federal or other government agencies or under the jurisdiction of local governments.		X
Review the conditions on the land covered by the plan at least every 5 years to determine whether conditions or demands of the public have changed significantly.		X
Monitoring and evaluation requirements provide a basis for a periodic determination of the effects of management practices.		
At intervals established in the plan, evaluate implementation on a sample basis to determine how well objectives have been met and how closely management standards and guidelines have been applied. Based upon this evaluation, the interdisciplinary team shall recommend to the Forest Supervisor such changes in management direction, revision, or amendments to the forest plan as are deemed necessary.		X
Provide for a quantitative estimate of performance comparing outputs and services with those projected by the forest plan.	X	
Provide for documentation of the measured prescriptions and effects, including significant changes in productivity of the land.		X
Provide for documentation of costs associated with carrying out the planned management prescriptions as compared with costs estimated in the forest plan.	X	
Determine whether lands are adequately restocked as specified in the forest plan.		X
Examine lands identified as not suited for timber production at least every 10 years to determine if they have become suited. If determined suited, return such lands to timber production.		X
Evaluate maximum size limits for harvest areas to determine whether such size limits should be continued.		X
Determine that destructive insects and disease organisms do not increase to potentially damaging levels following management activities.		X
Monitor the relationship between habitats provided on NFS lands and MIS population trends in cooperation with state fish and wildlife agencies, to the extent practicable. Population trends may be determined by a variety of methods considering best available science, including, but not limited to, data and analysis relating to habitat.	X	X
Evaluate the effects of vehicle use off roads and, classify areas and trails of National Forest System lands as to whether or not off-road vehicle use may be permitted.	X	

Monitoring Guidelines and Components

Monitoring Framework

Many approaches to Forest Plan monitoring are currently being used throughout the agency. However, each monitoring chapter must: 1) meet the legal requirements of the planning regulations, 2) be consistent with corporate data standards and protocols, and 3) be developed by an interdisciplinary team that addresses the ecological, social and economic dimensions of forest management in an integrated manner.

To meet these objectives, the Mark Twain National Forest’s monitoring framework has four components:

1. Forest Plan (Chapter 4) Direction that provides broad, strategic guidance.
2. A Monitoring and Evaluation Implementation Guide that provides specific, technical guidance.
3. An Annual Monitoring Schedule that outlines specific tasks for the current year.
4. An Annual Monitoring Evaluation Review that provides a forum to review current year findings and identify specific modifications if necessary.

The relationship between each is shown in Table 4-2.

Table 4-2. Monitoring framework.

Forest Plan Monitoring (Chapter 4)	Monitoring and Evaluation Implementation Guide	Annual Monitoring Schedule	Annual Monitoring Evaluation Review
Broad and Strategic. Provides the monitoring requirements in the forest plan itself. It focuses on what is needed to monitor the forest plan. It provides the overall monitoring strategy including specific questions that need to be answered, what will be monitored, timetables for reporting, and other information.	Focused and Technical; Describes how, where, and when to accomplish the monitoring prescribed in the forest plan. It provides the specific methods, protocols and analytical procedures. The Guide is intended to be flexible and could be modified in response to new information, updated procedures, emerging issues, and budgetary considerations without amending the forest plan.	Specific, Technical, and Prescriptive. Identifies precisely what will be monitored, where, when, and by whom for the current or upcoming year. The Annual Monitoring Schedule will be tied to the forest plan and monitoring guide.	Specific, Technical, and Prescriptive. The Forest interdisciplinary team will review the current year’s monitoring and evaluation results at the end of each calendar year. Based on these findings they will recommend to the Forest Leadership Team necessary changes (if any) to the Forest Plan, Monitoring Guide, or Forest Service Manual or Handbook.

Monitoring Prioritization

Within any agency or institution, necessary or desirable work demands often exceed available funding. Forest Plan monitoring is no exception. Consequently, a prioritization process for Chapter 4 and the Monitoring Guide items will be developed to ensure efficient use of limited time, money, and personnel. Following is a list of potential criteria that may be used in the screening process:

- Is monitoring of a particular question or resource mandated by regulation or court order?

- Is there a high degree of uncertainty associated with management assumptions? (Management Significance).
- Is there a high degree of disparity between existing and desired conditions?
- Are proposed management activities likely to affect resources of concern? (Ecological Significance).
- How do monitoring items fit into National and Regional priorities?
- How well do monitoring items fit with Public Comments?
- What are the consequences of not knowing resource conditions?
- Will monitoring respond to a key issue?

Monitoring priorities will be established each year utilizing the above criteria, information gained during the past year, and budgets. The prioritization process will be elaborated within the Monitoring Guide.

Information Management

There will be a tremendous amount of monitoring information collected over time. If this information is not documented so it can easily be retrieved, shared with the public and other stakeholders, or used by agency managers to foster better decisions, it is of limited value. Information management will consist of: (1) Management of the collection and storage of data (2) Evaluation and interpretation of data (3) Sharing of information internally and externally

Manage the Collection and Storage of Data

The interdisciplinary team review will work with Forest Service employees and cooperators to see that data is collected using standard methods found in the Monitoring Guide and is entered into the appropriate databases.

Evaluation and Interpretation of Data

Evaluation is the process of transforming data into information. It is a process of synthesis that brings together value, judgment, and reason with monitoring information to answer selected questions. Successful adaptive management depends on this information in moving the Forest toward desired conditions.

The Forest interdisciplinary team will review the current year's monitoring and evaluation results at the end of each calendar year. Based on these findings they will recommend to the Forest Leadership Team necessary changes (if any) to the Forest Plan, Monitoring Guide, or Forest Service Manual or Handbook.

Sharing of Monitoring Information and Findings

Information gathered through monitoring will be summarized in various reports (most notably the annual Monitoring and Evaluation Report) and publications and shared internally and externally with cooperating agencies and organizations, interest groups, policy makers, and the public.

Annual Monitoring and Evaluation Report

The annual monitoring and evaluation report (M and E) provides an opportunity to track progress towards the implementation of revised forest plan decisions and the effectiveness of specific management practices. The focus of the evaluation is in providing short and long-term guidance to ongoing management. The M and E report should include components such as:

1. Forest accomplishments toward desired conditions and outputs of goods and services.
2. Forest Plan Amendment Status.
3. Status of other agency/institution cooperative monitoring.
4. Summary of available information on MIS or comparable species.
5. Summary of large scale or significant projects or programs.
6. Update of research needs
7. Public participation/disclosure plan

Monitoring Matrix

Category #1 (Required), #2 (Desired Conditions, and Objectives) and #4 (effects of prescriptions, management practices, and off-road vehicles) are outlined in the matrix. The more prescriptive Standards and Guides (Category #3) will be addressed in the Monitoring Guide. The focal point for each monitoring item will be the Monitoring Question. Each Monitoring Question is derived from one or more Monitoring Drivers (Legal Requirements, Desired Conditions or objectives etc. See Table 4-2 for definitions). Not all monitoring drivers will be monitored each year. Annually drivers that best answer the monitoring question for each resource area will be identified through the Annual Monitoring Schedule process.

Table 4-3. Contents and definitions of the monitoring matrix.

Content	Definition
Resource Area	A quantitative or qualitative parameter that can be assessed.
Monitoring Question	Specific monitoring question(s) developed to ensure that monitoring and evaluation addresses information essential to measuring the Forest Plan. These questions relate to the different purposes and rationales for monitoring. There may be more than one monitoring question per resource area.
Monitoring Driver	Monitoring drivers identifies the reason or why we are monitoring a particular monitoring item. Following is a list of monitoring drivers: (1) Legal and regulatory requirements and Forest Service Manual direction and (2) Forest Plan desired conditions, goals, objectives, standards, and guidelines (S and G's). (3) Validation of assumptions and predictions, (4) Court rulings. Legal and regulatory drivers are described whereas desired conditions, goals, objective, and S and G's are referenced. Refer to Chapters 2 and 3 for full description of these drivers.
Measurement Frequency	Describes how often monitoring information is collected.
Evaluation and Reporting Frequency	Describes how often monitoring information is evaluated and reported.
Precision and Reliability	Two categories of precision and reliability are appropriate at the forest plan scale: Class A: Methods appropriate for modeling or quantitative measurement. Results have a high degree of repeatability, reliability, accuracy, and precision. Class B: Methods based on project records, personal communications, ocular estimates, pace transects, informal visitor surveys and similar types of assessments. The degree of repeatability, reliability, accuracy, and precision are not as high as Class A methods, but they still provide valuable information.

Table 4-4. Mandatory monitoring items.

Resource Area	Monitoring Question(s)	Monitoring Driver	Measurement Frequency/Mandatory?	Evaluation/Reporting Frequency	Precision and Reliability
All	How close are projected outputs and service to actual?	NFMA. A quantitative estimate of performance comparing outputs and services with those projected by the Forest Plan.	Annual	Annual	A
All	How close are projected costs to actual?	NFMA. Documentation of costs associated with carrying out the planned management prescriptions as compared with costs estimated in the Forest Plan.	Annual	Annual	A
Soils	Are the effects of Forest management, including prescriptions, resulting in significant changes to productivity of the land?	NFMA. Documentation of the measured prescriptions and effects, including significant changes in productivity of the land.	1-5 years	1-5 years	A/B
Timber	Are harvested lands adequately restocked after five years?	NFMA. Lands are adequately restocked as specified in the Forest Plan.	Annual	Annual	A
Timber	To what extent is timber management occurring on lands suitable for such production?	NFMA. Lands identified as not suited for timber production are examined at least every 10 years to determine if they have become suited; and that, if determined suited, such lands are returned to timber production.	10 years	10 years	A
Timber	Are timber management practices maintaining or restoring natural forest types, and encouraging healthier, more resilient and sustainable oak and oak-pine forests?	NFMA. Maximum size limits for harvest areas are evaluated to determine whether such size limits should be continued. Goal 2.4 - Timber Management Use timber management to restore degraded ecosystems, enhance the condition of terrestrial natural communities, reduce hazardous fuels, and move the forest toward a healthier desired condition.	10 years	10 years	B

Resource Area	Monitoring Question(s)	Monitoring Driver	Measurement Frequency/Mandatory?	Evaluation/Reporting Frequency	Precision and Reliability
Insects & Disease	Are insect and disease populations compatible with objectives for restoring or maintaining healthy forest conditions?	NFMA. Destructive insects and disease organisms do not increase to potentially damaging levels following management activities.	Annual	Annual	A/B
Wildlife	To what extent are forest management activities providing habitat for Management Indicator Species?	Goal 1.4	Annual	1-5 years	A/B
Off Road Vehicles	What are the effects of ORVs on the physical and social environment? How effective are forest management practices managing OHV use?	Off –road use shall be planned and implemented to protect land and other resources, promote public safety, and minimize conflicts with other uses of the National Forest System Lands. Forest planning shall evaluate the potential effects of vehicle use off roads and, on the basis of the requirement of 36 CFR 295 part of this chapter, classify management areas of the Forest as to whether or not off-road vehicle use may be permitted. Goal 2.3	Annual	1-5 years	A/B

Table 4-5. Monitoring items for goals, objectives, and standards.

Resource Area	Monitoring Question(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency	Precision and Reliability
Heritage Resources	Are avoidance or mitigation measures effective and being followed as recommended in project designs?	Goal 2.10	5 years	5 years	A
	Are heritage resources being affected in non-project areas?				
Land Adjustment	How successful is the Forest's land adjustment program in support and enhancement of Forest Plan desired conditions and objectives and contributing to efficient and effective stewardship?	Goal 2.6 Objective 2.6	2 years	5 years	A
Minerals	Are mineral exploration, development, and production stipulations effective and being followed as recommended in project designs?	Goal 2.5	1-5 years	1-5 years	A/B
Recreation	Does water in Forest-provided drinking water sources and swimming beaches meet standards of quality protective of human health and aesthetics?	Department of Natural Resources FSM 2300 Goal 2.8	Monthly during seasons of use	5 years	A
Recreation	To what extent do Forest recreation facilities and opportunities meet accessibility, health, safety, cost, and maintenance requirements and achieve resource and social objectives?	Goal 2.1 Goal 2.8	1-5 years	1-5 years	A/B
Recreation	To what extent is the Forest providing a range of motorized and non-motorized recreation opportunities that incorporate diverse public interests yet achieve applicable MA and LE objectives?	Goal 1.4 Goal 2.1 Goal 2.8 Goal 2.6 Goal 2.11	1-5 years	1-5 years	A/B

Resource Area	Monitoring Question(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency	Precision and Reliability
Recreation	To what extent are Forest management activities in semi-primitive management areas within the Recreation Opportunity Spectrum Objectives (ROS)?	Goal 2.8 Objectives under specific Management Prescriptions	1-5 years	5 years	A
Special Uses	Does Forest management of utility, recreation, and other used permits meet Forest Plan and agency direction?	Goal 2.1 Goal 2.8	1-5 years	1-5 years	A/B
NNIS	To what extent is Forest management contributing or responding to non-native invasive species?	Goal 1.2 Objective 1.2a FSM 2080	1-5 years	1-5 years	A/B
Wildlife	To what extent is Forest management providing habitat to maintain viable populations of native and desired non-native species?	Goal 1.4	1-5 years	1-5 years	A/B
Wildlife - RFSS	To what extent is Forest management contributing to the conservation of sensitive species and moving toward objective for their habitat conditions?	Goal 1.4 FSM 2670 FSH 2609	1-5 years	1-5 years	A/B
Wildlife - TES	To what extent is Forest management contributing to the conservation of threatened and endangered species and moving toward objective for their habitat conditions?	Goal 1.4 FSM 2670 FSH 2609	1-5 years	1-5 years	A/B
Wildlife – Old growth	How many acres are moving toward old growth desired future condition?	Goal 1.1	1-5 years	1-5 years	B
Wildlife – Aquatic	How many lakes and streams are being treated to improve down woody material?	Goal 1.3 and 1.4	1-5 years	1-5 years	B
Wildlife	Are key successional habitats being provided (open lands, regeneration, etc)	Goal 1.4	1-5 years	1-5 years	B
Wildlife	Are specialized habitats (caves, fens, seeps, springs, cliffs, rock outcrops, wetlands, etc) being protected, maintained and restored	Goal 1.4	1-5 years	1-5 years	B

Resource Area	Monitoring Question(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency	Precision and Reliability
Wildlife	Are key terrestrial habitats (hard mast, snags, down woody material, etc) being provided?	Goal 1.4	1-5 years	1-5 years	A/B
Fire	What level of wildland fire on the landscape is appropriate and desirable and, to what extent is unwanted wildland fire on the landscape suppressed?	Goal 2.2 Objective 2.2d Objective 2.2e	1-5 years	1-5 years	A,B
Fire	How, where, and to what extent will prescribed fire be used to maintain desired fuel levels, and/or mimic natural processes, and /or maintain/improve vegetative conditions, and/or restore natural processes and functions to ecosystems.	Goal 2.2 Objective 2.2a Objective 2.2b Objective 2.2c Objective 2.2e	1-5 years	1-5 years	A,B
Fire	Are fuel treatments effective?	Objective 2.2c	1-5 years	1-5 years	A,B
Air Quality	To what extent is the Forest management contributing or responding to air quality effects on ecosystems, human health, or human enjoyment?	Smoke Management S&G Minimize adverse effects on public health, safety, or visibility.	1-5 years	1-5 years	A,B
Air Quality	Are air quality related values of the Class I air sheds being maintained?	Smoke Management S&G Minimize impact on smoke-sensitive areas.	1-5 years	1-5 years	A,B
Ecosystem Sustainability	Are restoration activities increasing plant species richness for woodlands, glades and forests?	36 CFR 219.26, 27(g). Inventories to include quantitative data to evaluate diversity. Goal 1.1	Annual	1-5 years	A
Ecosystem Sustainability	Are we moving toward desired condition for groundcover and natural community type structural characteristics?	Goal 1.1, Objectives 1.1c and 1.1d; also see Appendix Restoration	Annual	1-5 years	B

Resource Area	Monitoring Question(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency	Precision and Reliability
Rangeland	To what extent has domestic livestock grazing been removed from glades and woodlands in MP 1.1 and 1.2?	Goal 1.1, MP 1.1 and 1.2 standards and rangeland guidelines to close grazing allotments when permits expire.	Annual	Annual	A
Social	What are the economic and social trends of this area?	Goal 2.1	1-4 years	1-4 years	B
Social	What are the effects of MTNF management on people and communities in areas adjacent to the forest?	Goal 2.1	2-4 years	2-4 years	B
Watershed Health & Riparian	To what extent is Forest management affecting water quality, quantity, and the physical features of aquatic, karst, riparian, or wetland ecosystems?	Goal 1.3	1-5 years	1-5 years	A/B
Transportation	Is a minimum transportation system being provided and maintained to meet resource management objectives?	Goal 2.3 FSM 7700	1-5 years	1-5 years	A/B
Transportation	Are unneeded roads being decommissioned in an effective manner?	Goal 2.3 FSM 7700	1-5 years	1-5 years	A