

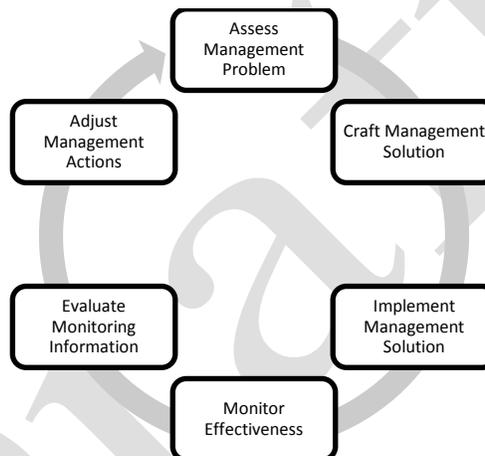
Chapter 6. Monitoring and Evaluation

Introduction

Monitoring and evaluation are separate and sequential activities required by National Forest Management Act regulations to determine how well the Forest Plan is working. Monitoring¹ involves collecting data by observation or measurement. Evaluation involves analyzing and interpreting monitoring data.

Monitoring and evaluation activities provide on-going feedback about management effectiveness and are essential elements of an adaptive management cycle that includes problem identification, solution, and implementation (Fig. 6-1). Monitoring and evaluation activities keep direction found in the Forest Plan up-to-date and relevant by being responsive to changing conditions and issues, including public desires, and to new information, such as research results or outcomes from management activities.

Figure 6-1. Monitoring and evaluation are elements of an “adaptive” management cycle.



Monitoring Strategy

A strategy for Forest Plan monitoring and evaluation has been designed to answer these three basic questions:

1. **Did we do what we said we were going to do?** This question answers how well the direction in the Forest Plan is being implemented. Collected information is compared to objectives, standards, guidelines, and management area direction.
2. **Did it work how we said it would?** This question answers whether the application of standards and guidelines is achieving objectives, and whether objectives are achieving desired conditions.

¹ The general purpose of monitoring is to detect changes or trends in a resource. Detection of a change or trend may trigger a management action, or it may generate a new line of inquiry. Monitoring data are most useful when the same methods are used to collect data at the same locations over time. It is important to note that cause and effect relationships usually cannot be demonstrated with monitoring data, but monitoring data might suggest a cause and effect relationship that can then be investigated with a research study.

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3. **Is our understanding and science correct?** This question answers whether the assumptions and predicted effects used to formulate the desired conditions and objectives are valid.

The following guiding principles are key elements of the monitoring strategy and serve as a framework for implementing an effective monitoring and evaluation program:

- Monitoring efforts are efficient, practical and affordable, make use of the best available science, and do not duplicate the collection of data already underway for other purposes.
- Monitoring tasks are scaled to the desired condition, objective, or management area direction to be monitored.
- Monitoring is not performed on every single activity, nor does it need to meet the statistical rigor of formal research.
- A monitoring action plan is prepared each year to identify specific items that should be monitored in the coming year. The annual monitoring action plan identifies and schedules various site-specific, on-the-ground monitoring activities. It also describes the methods, locations, responsible persons, and estimated costs.
- Budgetary constraints may affect the level of monitoring that can be done in a particular fiscal year. If budget levels limit the PNF's ability to perform all monitoring tasks, then those items specifically required by law are given the highest priority.
- Opportunities to complete monitoring and evaluation activities through partnerships and citizen collaboration are examined on a regular and on-going basis.
- A monitoring and evaluation report is prepared each year that summarizes the results of completed monitoring and evaluates the data for indicators of trends or effects.
- The forest supervisor annually evaluates the monitoring information displayed in the evaluation reports through a management review and determines if any changes are needed in management actions or the Plan itself.
- The public is given timely, accurate information about Forest Plan implementation. This is done through the release of the annual monitoring and evaluation report.

The specific monitoring questions and performance measures that could be used to evaluate movement toward Forest Plan desired conditions under this monitoring strategy are displayed below in Table 6-2(a-f) and arranged according to six monitoring themes:

- Legally Required Monitoring
- Conserving Biological Diversity
- Retaining Ecosystem Resilience
- Maintaining Watershed, Soil and Air Quality
- Sustaining Recreational and Social Benefits
- Maintaining Infrastructure Capacity

In some cases, the monitoring question and performance measures directly assess accomplishment of desired conditions. In other cases, they gauge objectives or guidelines associated with the desired conditions.

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For each monitoring question/performance measure listed in Table 6-2(a-f), additional monitoring descriptors are included to provide context for the type of information to gather and how often to gather it. These descriptors are defined here:

Monitoring Scale: Describes the level of analysis needed with respect to land size. This measure is important in describing habitat heterogeneity and viability issues, as well as describing cumulative effects of management actions.

Frequency of Monitoring: Describes how often information is gathered or measured such as annually, every three-five years, or every ten years.

Frequency of Evaluation: Defines how often the information is analyzed and reported. Depending upon the question being answered, analysis of the information may occur at longer time intervals than the frequency of monitoring.

Some resources need to be monitored annually to produce trend data. Annually gathered data may be analyzed periodically (3, 5 or 10-year cycle), depending upon the time frame specified by each objective.

Data Precision and Reliability: Precision refers to how close to each other repeated measurements of the same quantity are. Accuracy is a measure of how close a measurement is to the actual value of the variable being measured.

Two categories of precision and reliability are appropriate at the Forest Plan scale:

Class A: Methods generally are well accepted for modeling or quantitative measurement. Results have a high degree of repeatability, reliability, accuracy and precision.

Class B: Methods or measurements are 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.

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**Table 6-2a. Prescott Forest Plan Monitoring Questions:
Theme 1 – Legally Required Monitoring (from 1982 Planning Rule Section 219)**

Action, Effect or Resource to be Measured	Monitoring Question	Performance Measure	Scale	Monitoring Frequency	Evaluation/Reporting Frequency	Data Precision/Reliability
Comparison of projected and actual outputs and services (Section 219.12(k)(1))	How close are projected outputs and services to actual?	Amount of outputs and services	Forest	Annually	Every 5 years	A
Prescriptions and effects (Section 219.12(k)(2))	Are the effects of Forest management, including prescriptions, resulting in significant changes to productivity of the land?	Soil/plant productivity	PNVT	Every 5 years	Every 5 years	B
Comparison of actual and estimated costs (Section 219.12(k)(3))	How close are projected costs with actual costs?	Dollars	Forest	Annually	Every 5 years	A
Lands are adequately restocked (Section 219.12(k)(5)(i))	Are harvested lands adequately restocked after five years?	% survival on restocked land	Forest	Annually	Every 5 years	A
Lands not suited for timber production (Section 219.12(k)(5)(ii))	To what extent is timber management occurring on lands suitable for such production?	Number of unsuited acres	Forest	Every 10 years	Every 10 years	A
Maximum opening from even-aged management (Section 219.12(k)(5)(iii))	How much even-aged management (especially clear cutting) should be used, and in what vegetation types should it be used?	Acres	PNVT	Every 5 years	Every 5 years	A
Control of destructive insects and disease (Section 219.12(k)(5)(iv))	To what extent are undesirable outbreaks of native insects and pathogens being managed on the PNF?	Acres of infestation or plant mortality	Forest	Annually	Every 5 years	B
Population trends of the Management Indicator Species in relation to habitat changes (Section 219.19(a)(6))	What are the trends in habitat for Management Indicator Species on the PNF?	MIS habitat estimates	Forest	Annually	Every 5 years	A

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**Table 6-2b. Prescott Forest Plan Monitoring Questions:
Theme 2 – Conserving Biological Diversity**

Action, Effect or Resource to be Measured	Monitoring Question	Performance Measure	Scale	Monitoring Frequency	Evaluation/Reporting Frequency	Data Precision/Reliability
Vegetation Diversity (O-1,O-2,O-3,O-4,O-5,O-6, DC-Veg-1)	What are the current condition and trend of key characteristics for vegetation identified in the desired conditions for the plan area?	Age class, size class, % canopy cover, composition	PNVT	Every 5 years	Every 5 years	A
	How effective are management actions at maintaining or making progress toward desired conditions for the key characteristics of vegetation within the plan area?	Acres of treatment by treatment type	PNVT	Annually	Every 5 years	B
Rare and Narrow Endemic Plant Species (DC-Veg-5)	Is management effectively protecting rare and narrow endemic plant species during project implementation?	Species abundance & distribution	Project	Annually	Annually	B
Species Diversity (O-2,O-3, O-29,O-30,O-31,O-32, DC-Ecosystem Resilience-1,DC-Wildlife-1)	To what extent are management activities providing ecological conditions to maintain viable populations of native and desired non-native species?	Breeding Bird Surveys	Forest	Annually	Every 5 years	B
Aquatic Species (O-25,O-26,O-27,O-28)	What are the current condition and trend of key characteristics for aquatic habitat identified in the desired conditions for the plan area?	Species abundance	Watershed	Annually	Every 5 years	B
	How effective are management actions at maintaining or making progress toward desired habitat conditions for native fish, amphibian and reptile species?	Species present				
Federally Listed and Other Sensitive Species (DC-Ecosystem Resilience-1)	Have recovery or conservation strategies for TE&S species been implemented?	Number of plans initiated	Forest	Every 5 years	Every 5 years	B
	What are the population trends for TE&S species known to occur as reproducing populations on the PNF?	Population estimates				

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**Table 6-2c. Prescott Forest Plan Monitoring Questions:
Theme 3 – Retaining Ecosystem Resilience**

Action, Effect or Resource to be Measured	Monitoring Question	Performance Measure	Scale	Monitoring Frequency	Evaluation/Reporting Frequency	Data Precision/Reliability
Non-native Invasive Species (O-6)	What are the status and trend of areas infested by invasive plant species?	Acres of invasive species occurrence; Acres of infestation treated	PNVT	Annually	Every 5 years	B
	What are the status and trend of areas infested by invasive vertebrate species?		Watershed			
Native Insects and Pathogens (DC-Ecosystem Resilience-1)	What are the status and trends of outbreaks of native insects and pathogens within the plan area?	Acres of insect or pathogen outbreak; acres of plant mortality	Forest	Annually	Annually	B
	Are insect and disease populations compatible with objectives for restoring or maintaining healthy forest conditions?					
Fire (O-1,O-2,O-3,O-4,O-5)	How effective are management actions in moving toward desired fire regime conditions?	Acres treated by fire severity type	PNVT	Annually	Every 5 years	B
	What level of wildland fire on the landscape is appropriate and desirable, and to what extent is unwanted wildfire on the landscape suppressed?	Acres of managed fire; acres of suppressed fire				
	To what extent is prescribed fire used to maintain desired fuel levels, and/or mirror natural processes, and or restore desired vegetation characteristics?	Acres of Rx fire by fuel type; fuel loading by fuel model				
	Has the risk for active crown fire been sufficiently reduced in fire-adapted ecosystems?	Predicted fire behavior by fuel type/loading				
Climate Change (DC-Ecosystem Resilience-1)	To what extent are extreme weather events (e.g. flash floods, wind, droughts) modifying watershed conditions?	Hydrograph characteristics	Watershed	Annually	Every 5 years	B
	To what extent are annual weather patterns (e.g. precipitation and air temperature) affecting fire season length and severity?	EnergyRelease Component (ERC) levels by fuel type	Forest	Annually	Every 5 years	A

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**Table 6-2d. Prescott Forest Plan Monitoring Questions:
Theme 4 – Maintaining Watershed, Soil, and Air Quality**

Action, Effect or Resource to be Measured	Monitoring Question	Performance Measure	Scale	Monitoring Frequency	Evaluation/Reporting Frequency	Data Precision/Reliability
Watershed conditions that influence water quality (O-17,O-18,O-19,O-20, O-22)	How effective are management actions in improving conditions for riparian areas, seeps and springs, and high priority watersheds?	Number of restored sites	Project	Annually	Every 5 years	B
	How effective are management actions at reducing the amount of area that adds sediment to streams, damages riparian vegetation, erodes streambanks, compacts floodplain soils, or causes gullies?	Miles of former roads or trails improved	Watershed	Annually	Every 5 years	A
Watershed conditions that influence water yield and timing of delivery (O-21,O-24)	How effective are management actions in improving stream flow and sediment transport?	Number of improved road or trail and stream crossings	Project	Annually	Every 5 years	B
	How effective are management actions in providing for channel and floodplain maintenance and recharge of riparian aquifers?	Number of instream flow water rights	Watershed	Annually	Every 5 years	A
Watershed conditions that influence soil productivity (O-23)	How effective are management actions in improving soil quality conditions from a rating of unsatisfactory or impaired to satisfactory?	Change in soil quality rating	Project	Every 5 years	Every 5 years	B
Airshed conditions (DC-airshed-1)	To what extent are management activities contributing or responding to air quality effects on human health or human enjoyment?	Smoke complaints	Airshed	Annually	Annually	A
	Are air quality related values of Sycamore Canyon and Pine Mountain Wildereness Areas being maintained?	Visibility (deciviews)	Airshed	Annually	Every 5 years	A

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**Table 6-2e. Prescott Forest Plan Monitoring Questions:
Theme 5 – Sustaining Recreational and Social Benefits**

Action, Effect or Resource to be Measured	Monitoring Question	Performance Measure	Scale	Monitoring Frequency	Evaluation/Reporting Frequency	Data Precision/Reliability
Diverse Recreation Experiences (O-7, O-8,O-10,O-13,O-14,O-16)	How many new recreation sites or locations have been added to the system? How many recreation sites or locations have been improved, relocated or decommissioned in response to known resource damage?	Number of facilities or sites, INFRA	Forest	Annually	Every 5 years	A
	Does the number of recreation opportunities limit overcrowding, reduce user conflicts, and minimize resource damage? Does the range of recreation experiences consider population demographic characteristics and desires of the local communities?	User satisfaction surveys, NVUM	Forest	Annually	Every 5 years	A
	Do visitors learn from their PNF experiences?	Number of visitor contacts and education activity	Forest	Annually	Annually	A
	Scenery (DC-Scenic-1)	Are forest management activities providing scenic quality as defined by Scenic Integrity Objectives (SIO)?	SIO	Forest	Annually	Annually
Land Adjustment (DC-Open Space-1, DC-Lands-1, O-33)	To what extent is the PNF land adjustment program supporting or enhancing Forest Plan desired conditions (open space, scenery values)?	Area of land adjustment that meets open space desires	Forest	Annually	Every 5 years	A
Minerals Management (DC-Minerals-1)	Are mineral exploration, development and production avoidance or mitigation measures effective and being followed as recommended in project designs?	Water quality classifications, number of bat habitat improvements	Project	Annually	Annually	A

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**Table 6-2f. Prescott Forest Plan Monitoring Questions:
Theme 6 – Maintaining Infrastructure Capacity**

Action, Effect or Resource to be Measured	Monitoring Question	Performance Measure	Scale	Monitoring Frequency	Evaluation/Reporting Frequency	Data Precision/Reliability
Roads, Trails, and Facilities (O-9, O-11, O-12, O-15) (DC-Transportation & Facilities-1)	How many miles of the designated roads and trails are maintained to standard?	Miles of roads and trails	Forest	Annually	Annually	A
	How many developed and dispersed recreation sites are maintained to standard?	Percentage of sites maintained	Forest	Annually	Annually	A
	What proportion of trailheads and wilderness boundaries are adequately signed or marked?	Percentage of total trailheads; percentage of Wilderness boundary	Forest	Annually	Every 5 years	A
	Are PNF facilities and recreation sites safe for employees and public use and enjoyment?	Number of incidents	Forest	Annually	Annually	A
	To what extent is the PNF providing a range of motorized and non-motorized recreation opportunities that incorporate diverse public interests yet achieve applicable MA and LE objectives?	Miles by type, MVUM	Forest or Management Area	Annually	Every 5 years	A
	Where is the unauthorized use occurring on or off the road and trail system?	Number of citations issued by location	Forest	Annually	Annually	A