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Green Mountain National Forest

Land and Resource Management Plan

Chapter 4 Monitoring and Evaluation

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Chapter 4 Monitoring and Evaluation

Rain Gauge Monitoring in Lincoln, Vermont

Bat Monitoring

4.1 MONITORING AND EVALUATION

4.1.1 Introduction

The Green Mountain National Forest Land and Resource Management Plan (Forest Plan) provides management direction in terms of desired conditions, goals, objectives, and standards and guidelines at the Forest and Management Area scales. Monitoring and evaluation are separate, sequential activities required by the National Forest Management Act (NFMA) to determine how well this management direction is being met, and to provide a basis for the periodic evaluation of the Forest Plan. The Green Mountain National Forest Monitoring Program (Chapter 4 of the Forest Plan) describes what will be monitored and what Forest Service staff expect to learn from that monitoring and subsequent evaluation.

Monitoring is the systematic collection of information about resource conditions, management actions, and emerging issues in a way that will reflect changes in conditions and relationships over time and space. The objective of a plan monitoring program is to:

1. Enable the Responsible Official to determine if a change in Forest Plan components or other Forest Plan content may be needed.
2. Inform the management of resources through means such as testing relevant assumptions, tracking relevant changes, and measuring management effectiveness and progress toward achieving or maintaining the Forest Plan's desired conditions or objectives.
3. Support an adaptive land management planning process that includes social, economic, and ecological evaluations.

Evaluation is the analysis and interpretation of the information collected during monitoring. Evaluation results form the basis for adaptively managing National Forests because they:

1. Evaluate the validity of assumptions used in Forest Plan development,
2. Verify the effectiveness of Forest Plan standards and guidelines,
3. Assess program and project effects on resource conditions in relation to management goals and desired conditions, and
4. Determine when goals, objectives, desired conditions, standards, or guidelines need to change.

The Forest Plan Monitoring Program falls into three general areas of focus, depending on whether they examine the *implementation* or *effectiveness* of management actions, or the *validity* of the underlying assumptions on which management is founded (Table 4.1-1).

Table 4.1-1: Monitoring Categories

Monitoring Focus	Purpose
Implementation	Is the overall direction in the Forest Plan being implemented? This includes goals and objectives, desired conditions, standards and guidelines, and management area direction. ***Or***, Did we do what we said we were going to do?
Effectiveness	Are the standards and guidelines working? Are there significant changes in productivity of the land? ***Or*** Did it work?
Validation	Are the assumptions and predicted effects used to formulate the Forest Plan accurate? ***Or*** Were we right in our initial understanding of the situation? Did we look at the right things?

These three areas of focus are interwoven within the monitoring and evaluation plan as a means of measuring the Forest Service's success in achieving Forest Plan goals and objectives, and applying Forest Plan standards and guidelines. Monitoring design and data collection follow accepted national standards. Monitoring is not performed on every activity, nor is most of it expected to meet the statistical rigor of formal research.

Implementation monitoring is done primarily at the project level and is completed on a day-to-day basis. It occurs hundreds of times each year and includes activities such as timber sale inspections, interdisciplinary project reviews, backcountry observations by Wilderness rangers, and construction inspections. Effectiveness and validation monitoring are more programmatic which entails Forest-wide monitoring that is done annually or every few years to track long-term progress and effects.

4.1.2 Adaptive Management

Knowledge gained through monitoring, evaluation, and associated research provides the basis of adaptive management. The process creates a feedback mechanism (Figure 4.1-1) whereby Forest Service staff can compare observed results and trends with desired goals and outcomes, or examine or test the scientific appropriateness and validity of assumptions used in the development of the Forest Plan.

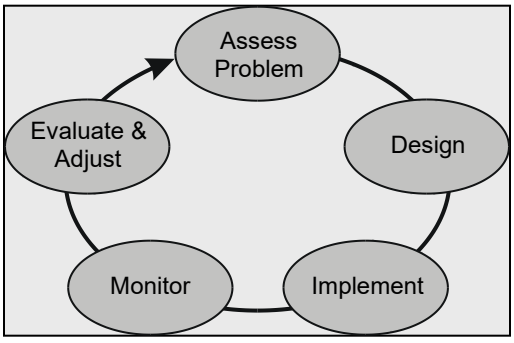

Figure 4.1-1: Monitoring, Evaluation, and Adaptive Management

Using results from monitoring and evaluation as a guide, the Forest Service can develop amendments to management direction as necessary. In this way, monitoring and evaluation help keep the Forest Plan dynamic, relevant, and responsive to changing issues.

4.1.3 Monitoring and Evaluation Components

An integrated and comprehensive monitoring and evaluation program includes four phases or components:

1. Monitoring Plan
2. Monitoring Implementation Guide
3. Annual Monitoring Schedule
4. Biennial Monitoring and Evaluation Report

Monitoring Plan

The *Monitoring Plan*, which is contained in this chapter, provides the conceptual framework for specific monitoring and evaluation elements. It establishes questions to be answered, timeframes for reporting, and indicators for required monitoring topics. Monitoring Plan direction is broad and ties directly to decisions made in this Forest Plan.

Monitoring items and questions included here are intended to provide the basis for more specific and focused monitoring items to be included in the *Monitoring Implementation Guide*. Changing the Monitoring Plan requires an Administrative Change to the Forest Plan (36 CFR 219.13).

Monitoring Implementation Guide

The *Monitoring Implementation Guide* (Guide), sometimes referred to as the *Monitoring Guide* or the *Implementation Guide*, is a procedural document that is external to the Forest Plan. It describes the Forest Service's monitoring program in its entirety. The Monitoring Guide is founded on guidance contained in the Monitoring Plan, expanded into greater detail. The Monitoring Guide contains specific

monitoring elements, along with methods, protocols, and analytical procedures to be followed. The Monitoring Guide incorporates direction found in the Forest Service handbook, technical manuals, scientific literature, or other sources.

Program managers responsible for Forest Plan implementation are involved in updating the Monitoring Guide. The list of monitoring items is beyond that normally funded; final selection of the items to be monitored in a given year is primarily based on available funding and staffing, and the priorities and timing provided in the Monitoring Guide.

The Monitoring Guide is intended to be a flexible component that can change as new methodologies and techniques are developed, or to be more responsive to changing needs and new information. The Monitoring Guide can be modified without an Administrative Change to the Forest Plan.

Annual Monitoring Schedule

The *Annual Monitoring Schedule* outlines monitoring items, time frames, roles, and locations for the upcoming year. The annual monitoring schedule will be linked directly to both the Forest Plan and the Monitoring Implementation Guide. The Forest Service will prepare and revise this schedule annually as part of the annual work planning process. Some elements of the Guide will be performed or measured annually, whereas others will be scheduled with other time intervals that are determined necessary or appropriate for timely and effective evaluation. The Forest Service's annual work planning process also will establish or revise priorities for the monitoring schedule.

Biennial Monitoring and Evaluation Report

Every two years, Forest Service staff will produce and make available a *Biennial Monitoring and Evaluation Report* that shares new information gathered through the Monitoring Program and relevant information from the broader-scale strategy. The purpose of the biennial report is to:

1. Make the information obtained from monitoring available to the public in a form that is readily understandable.
2. Transform monitoring data into information that supports adaptive management so the Responsible Official can determine whether changes to the Forest Plan, management activities, or the Monitoring Program are warranted.

4.1.4 Monitoring Plan

The Green Mountain National Forest Monitoring Plan consists of a set of required monitoring questions (Table 4.1-2). Evaluation of information collected to answer each monitoring question provides the Responsible Official the basis to determine whether changes are needed to Forest Plan components (goals, objectives, desired conditions, and standards and guidelines). These changes can be made through the amendment process to ensure the Forest Plan remains current by adapting to new information and changed conditions.

The Monitoring Plan also provides information to track resource trends, and measure management effectiveness and progress toward achieving Forest Plan goals, objectives, and desired conditions. Lastly, evaluation of monitoring information may provide the basis for design changes to management activities to better meet overall Forest Plan direction.

4.1.5 Required Monitoring

The National Forest System Land Management Planning Rule (36 CFR 219.12(a)(5)) requires the Forest Plan Monitoring Plan to include at least one monitoring question and associated indicator(s) for each of eight monitoring elements. Table 4.1-2 shows the monitoring questions and associated measurement indicators selected to address each element.

Table 4.1-2: Required Monitoring Elements

Required Element	Monitoring Question	Measurement Indicator(s)
1. Status of select watershed conditions.	To what extent are management activities maintaining or restoring watershed functions?	• Number of sub-watersheds in each watershed condition class • Number of essential projects completed in priority watersheds per year
2. Status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems.	To what extent are management activities and natural processes leading to increased structural diversity within forested stands and across forested landscapes, moving areas toward desired objectives identified under Goal 2 of the Forest Plan?	• Number of acres and proportion of each forest type in each age class • Number of acres and proportion of harvest acres treated with uneven-aged management • Number of acres treated explicitly to enhance early successional characteristics • Number of acres treated explicitly to enhance late successional characteristics • Number of acres treated with various methods to explicitly enhance health, longevity, and/or structural diversity of forested stands at the stand and landscape scales
	To what extent are management activities conserving or improving water quality?	• Miles of stream and acres of lake/ pond on National Forest System lands by Vermont water quality classification • Ambient Biomonitoring Network stream reach score for a representative subset of stream reaches across GMNF • Implementation and effectiveness monitoring for Best Management Practices (BMPs)
3. The status of focal species to assess the ecological conditions required under § 219.9.	Does the headwater streams ecosystem provide a full array of riparian and aquatic communities and stream channel types supported by the varied physiographic conditions across the Forest?	• Number of wild brook trout (*Salvelinus fontinalis*) per stream mile
4. The status of a select set of the ecological conditions required under § 219.9 to contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern.	What are the population trends for sensitive plants (increasing, decreasing, or stable)? To what extent are management activities affecting conditions for sensitive plant populations?	Population trends for plants listed as Regional Forester Sensitive Species: • Number of ramets or genets • Percent reproductive • Spatial extent of population • Number of populations of a species • Ranked condition of populations

Required Element	Monitoring Question	Measurement Indicator(s)
5. The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.	To what extent are management activities providing high quality recreation services that meet the expectations of the public?	• Percent Meets Expectations (PMEs) in National Visitor Use Monitoring (mean visitor satisfaction compared to mean importance). PME data reported for developed facilities, access, services, and feeling of safety in developed sites, undeveloped areas, and designated wilderness. • Trend in number of visitors, visitor satisfaction and changes in visitor participation by activity over 5-year NVUM reporting periods.
6. Measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area.	Within site plots how are soil/site quality and productivity changing over the long term in response to factors such as acid deposition, climate change, invasive species, and other environmental problems? How are management activities potentially mitigating or exacerbating changes in soils? More specifically: Are soil nutrient levels changing, and are the changes affecting soil/site productivity? What toxins exist in the soil (such as from the atmosphere), and how are they changing in quantity and type over time? Is this affecting productivity?	Within site plots established in wilderness areas measure changes over time for: • Soil quality - Soil nutrient levels, soil organic matter, total soil carbon, and toxins by major horizon • Soil productivity - Forest health • Soil climate - Soil temperature and moisture, depth of freezing, correlated with selected meteorological parameters
	To what extent are insects and disease organisms impacting forest conditions?	Insect or disease infestations: • Number of outbreaks by species • Acres affected by species • Trends in outbreak persistence, spread, and associated tree mortality
7. Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities.	How do actual resource and service accomplishments compare to those projected in the Forest Plan Appendix D, Proposed and Probable Practices?	• Actual annual resource and service accomplishments for management activities listed in the Forest Plan, Appendix D, Table D-5.
8. The effects of each management system to determine that they do not substantially and	To what extent are management activities impacting soil quality and productivity?	Within the Forest Service Soil Disturbance Monitoring Protocol sampling and monitoring areas including select areas where timber harvest, prescribed

Required Element	Monitoring Question	Measurement Indicator(s)
permanently impair the productivity of the land (16 U.S.C. 1604(g)(3)(C)).		fire, and other management activities have been implemented: • Amount of forest floor impacted • Amount of topsoil displacement • Severity of rutted, burned or compacted soil • Severity of platy/massive soil structures, or puddled soil

4.1.6 Other Monitoring

In addition to the monitoring questions selected to address the eight required elements listed in Table 4.1-2, other monitoring questions have been developed to assist in determining how well management activities are meeting Forest Plan direction. While none of these questions have been selected to address any of the required elements and are not part of the formal Monitoring Plan, Forest Service staff can use them to supplement the monitoring and evaluation plan to improve the Forest Plan or refine management activities pending budget and staffing capacity. The details for these other monitoring questions can be found in the Monitoring Guide including the Forest Plan component they address, associated measurement indicators, monitoring protocol and methodology, and reporting frequency.

4.1.7 Biennial Monitoring and Evaluation Report

Information derived from the monitoring and evaluation of required and other monitoring questions forms the basis for continuous improvement of the Forest Plan needed for consideration for adaptive management strategies. Biennial monitoring and evaluation reporting is key for the Responsible Official to determine if and where changes are needed in Forest Plan components, other Forest Plan content, and projects and activities. Monitoring also provides feedback to prioritize and improve the Monitoring Program and broader-scale monitoring strategy provided by other monitoring questions.

The biennial evaluation of monitoring is intended to collect, evaluate, and report on new data or results. The report does not need to evaluate all questions or indicators on a biennial basis but must focus on new data and results that provide new information for adaptive management.

Every two years, the Forest Service will summarize what monitoring has been completed and the most recent evaluation results. At a minimum, the evaluation should:

1. Enable the Responsible Official to assess if there have been changes in the condition of the land that indicate a need for changes to Forest Plan components, the Monitoring Program, or management activities.
2. Be used to inform adaptive management of the plan area.
3. Provide a basis for determining the accuracy of management effects.
4. Consider how well goals, objectives, and desired conditions have been met and how closely standards and guidelines have been applied.