CHAPTER 4

Monitoring and Evaluation



"A major determinant of how well American forestry prepares for the 21st century will be cooperation in resources management. This means cooperation among federal, state, and private ownerships... and cooperation with new and different arrangements of people and organizations."

John R. McGuire Forest Service Chief (1972-1979)

Monitoring Plan

Introduction

Monitoring and evaluation determines how well the Forest Plan is working. It is designed to answer the following questions:

- Did we do what we said we were going to do? This question addresses how well the Forest Plan direction is being implemented. Collected information is compared to objectives, standards, guidelines and management area direction.
- Did it work how we said it would? This question addresses whether the application of standards and guidelines is achieving objectives; and whether objectives are achieving goals.
- Is our understanding and science correct? This question addresses whether the assumptions and predicted effects used to formulate the goals and objectives are valid.

The aim of monitoring is to be able to respond to current conditions or to make appropriate changes based on new information or technology. Depending on the answers to the above questions, the Forest Plan may be amended or revised to adapt to new information and changed conditions.

This chapter provides programmatic direction for monitoring and evaluating Forest Plan implementation.

Monitoring and Evaluation Strategy

Monitoring and evaluation are separate activities. Monitoring is the process of collecting data and information. Evaluation analyzes and interprets the information and data collected from monitoring.

A key requirement of a monitoring strategy is that the public be given timely, accurate information about Forest Plan implementation. This is done through the release of a biennial monitoring and evaluation report.

The monitoring program must be efficient, practical and affordable, and not duplicate the collection of data already underway for other purposes. Monitoring tasks are scaled to the Forest Plan, program or project to be monitored. Each of these entails different objectives and requirements.

Monitoring is not performed on every single activity, nor does it need to meet the statistical rigor of formal research. Budgetary constraints will affect the level of monitoring that can be done in a particular fiscal year. If budget levels limit the Forest's ability to perform all monitoring tasks, then those items specifically required by law would be given the highest priority.

Monitoring Methods and Questions

Monitoring methods categorize how precisely and reliably we measure monitoring items. Monitoring questions were developed by an interdisciplinary team to address Forest Plan management goals, objectives, standards, guidelines, assumptions and science. The annual monitoring plan identifies which items will be measured and how the monitoring questions will be answered. The biennial monitoring and evaluation report analyzes and summarizes the monitoring results.

Monitoring is divided into two methods which are based on their relative precision and reliability:

Method A: These methods are well-accepted for modeling or measuring the resource or condition. The methods are appropriate for modeling or quantitative measurements. Results have a high degree of repeatability, reliability, accuracy and precision. The cost of conducting these measurements is higher than other methods.

Method B: These methods or measurement tools are based on a variety of techniques. Tools include project records, communications, on-site visual estimates or less formal measurements such as informal visitor surveys, air photo interpretation and other similar types of assessments. Method B is often qualitative in nature, but still provides valuable information on the status of resource conditions. Reliability, accuracy and precision are lower than Class A methods, but still provide valuable information.

Monitoring Guidelines and Components

Monitoring Framework: Monitoring and evaluation is a complex process that takes on many forms and applies to many programs. Deciding what resources to monitor, how, why, how often and by whom, requires consideration of several important guidelines.

In addition, monitoring must also:

- Meet the legal requirements of the planning regulations;
- 2. Be consistent with corporate data standards and protocols;
- 3. Be developed by an interdisciplinary team that addresses the ecological, social and economic dimensions of forest management in an integrated manner.

Table 4-1 identifies the four components that the Hiawatha National Forest will use as part of the monitoring framework.

Table 4-1. Monitoring Fra	mework		
Forest Plan Monitoring	Monitoring and Evaluation Implementation Guide	Annual Monitoring Schedule	Monitoring Evaluation Review
 Broad and strategic Provides the monitoring requirements in the Forest Plan itself. Focuses on what is needed to monitor the Forest Plan. Provides the overall monitoring strategy including specific questions that need to be answered; what will be monitored; timetables for reporting and other information. 	 Focused & technical Describes how, where and when to accomplish the monitoring prescribed in the Plan. Provides the specific methods, protocols and analytical procedures. Is flexible and can be modified in response to new information, updated procedures, emerging issues and budgetary considerations without amending the Plan. 	Specific, technical and prescriptive Identifies precisely what will be monitored, where, when and by whom for the current or upcoming year. Is tied to the Forest Plan and Monitoring Guide.	Specific, technical and prescriptive ■ The Forest Interdisciplinary Team will review monitoring and evaluation results on a regular basis described in Table 4-3. ■ The ID team will recommend to the Forest Leadership Team necessary changes (if any) to the Forest Plan or Monitoring Guide.

Monitoring Prioritization

The level and intensity of monitoring and analysis will vary with the budget, information gained during previous years and other forest priorities. The following list of potential criteria may be used to set monitoring priorities:

- Is monitoring of a particular question or resource mandated by regulation or court order?
- Will monitoring respond to a key issue?

- 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?
- What are the consequences of not knowing resource conditions?

Evaluation and Interpretation of Data: Evaluation is the process of transforming data into information. It is a process that brings together values, judgement and reason with monitoring information, to answer selected questions. Successful adaptive management depends on this information to move the Forest towards desired conditions.

The Forest interdisciplinary team will review the current year's monitoring and evaluation results and make recommendations for changes to the Forest Plan or changes to the Monitoring Guide.

Monitoring and Evaluation Report: This biennial report provides an opportunity to track progress towards the implementation of the revised forest plan decisions and the effectiveness of specific management practices. The focus of the evaluation is more internal to the Forest Service in providing immediate guidance to ongoing management.

This evaluation is tied specifically to the questions identified for each monitoring element.

Monitoring Matrix

Monitoring direction is outlined in the matrix. The more prescriptive standards and guides will be addressed in the Monitoring and Evaluation 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. objectives etc.) Table 4-2 defines the components of the monitoring matrix. Not all monitoring drivers will be monitored each year. Drivers that best answer the monitoring question for each resource area will be identified during the annual monitoring schedule process.

Table 4-2. Definitions of Compo	onents in the Monitoring Matrix
Component	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	A monitoring driver 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, (2) Forest Plan desired conditions, goals, objectives standards and guidelines, (3) Validation of assumptions and predictions and (4) Court ruling. Legal and regulatory drivers are described whereas desired conditions, goals, objectives, and standards and guidelines are referenced. Refer to chapters 2 and 3 for a full description of these drivers.
Monitoring Indicator	A characteristic which, when measured repeatedly, demonstrates trends, or a measure of the current state or quality of the associated Monitoring Question.

Table 4-3. Monitoring Items				
Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
Monitoring Element: Status of select watershed conditions (36 CFR 219.12(a)(5)(i)).	See below.	2012 Planning Rule Required Monitoring Element	See below.	See below.
To what extent is Forest Plan implementation affecting streams, lakes, ponds and wetlands and their associated riparian ecosystems?	Acres of streams, lakes, ponds and wetland and riparian ecosystems affected	BMP Implementation and Effectiveness Monitoring (use National BMP protocols, evaluate % implemented and % effective)	Project by project	2-6 years
To what extent are we moving riparian corridors toward the desired condition?	Miles of roads and trails obliterated, relocated outside of or improved in the riparian corridor	Forest Plan Watershed Management Objective 1	- Annually	
	Number of barriers removed for aquatic organism passage and to improve flow and sediment transport	Forest Plan Watershed Management Objective 2		2 years
	Acres of non-native invasive species treated in riparian areas and wetlands	Forest Plan Watershed Management Objective 6; Forest Plan Aquatic Ecosystems Standards and Guidelines		
	Acres of riparian vegetation improvements	Forest Plan Watershed Management Objective 7		
	Watershed Condition Class Score (25 indicators)	Forest Plan Watershed Management Objective #4 and #52011 Watershed	A 11	9.6
	Percentage of fifth level watersheds with improved condition classes	Condition Class Framework assessment of 6th level subwatersheds	Annually	2-6 years
How is the Forest complying with the Clean Water Act requirements?	Effectiveness of Best Management Practices (BMP) application	Clean Water Act (33 U.S.C §1251 et seq. (1972)); Forest Service Policy for Water Quality Management; National Core BMP Monitoring Program; Forest Plan Watershed Management Goal 5 - Water quality is maintained to the standards identified by the State of Michigan	Annually	2 years

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
Monitoring Element: Status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems (36 CFR 219.12(a)(5)(ii)).	See below.	2012 Planning Rule Required Monitoring Element	See below.	
To what extent are ecologically healthy and productive aquatic ecosystems being restored?	Number of miles of riparian and in-channel stream habitat restored or enhanced during the planning period	Forest Plan Wildlife Objectives 1, 2, 3; Watershed Goals 3-8; Watershed desired condition		
	Number of lakes restored or enhanced during the planning period	Forest Plan Wildlife Objective 2	Annually	2 years
	Number and location of wetlands with aquatic invasive species present or absent	Forest Plan Aquatic Ecosystems		
	Acres treated to control aquatic invasive species	Standards and Guidelines and Soil Resources Objectives		
	Number of educational contacts related to aquatic invasive species			
	Acres of soil hydrologic function impaired by past management activities	Forest Plan Soils Resource Objective 2		
	Trends in desired native fish population.	2600 – Wildlife, Fish and Sensitive Plant Habitat Management Goals 3, 5, and 6 and Objectives 1, 2, and 3		
To what extent is the Forest maintaining or restoring	Acres of prescribed burn to restore wetland and terrestrial habitat		Annually	
conditions that result from or emulate natural ecological processes?	Number of years since fire occurred compared to historical fire regimes for a given ELTP or biophysical setting	Vegetation Management desired condition 1-3; Goals 1-3; Fire Management desired condition 3		2 years
	Plant and animal population change before and after management that emulates natural ecological processes (prescribed burning, some timber harvest, mechanical opening treatments, stream flow restoration, etc.)		Annually	10 years

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
	Compare the current percent of acres measured against the 2005/2006 desired future condition by MA, ELT, early-, mid- and late seral condition and tree size classes		Annually	10 years
To what extent are insects and disease populations compatible with objectives for restoring or	Acres, disturbance patterns, severity and trends observed by annual aerial flights for insect and disease damage	Vegetation Management desired	Annually	
maintaining healthy forest conditions?	Site visits for insect and disease observations	11.1 4 T D 14	Measured as needed based on the indicator above	2 years
To what extent is Forest management managing undesirable occurrences of fire, insect and disease outbreaks?	Acres harvested by salvage or for sanitation; compare acres treated to acres identified in previous monitoring question	Pest Management Guidelines 1-4	Annually	2 years
To what extent is Forest management providing ecological conditions to maintain habitat of	Acres of habitat in the appropriate ecological condition needed for native and desired non-native species	TES Goals 1,3; Vegetation Management Guidelines 2,3; Wildlife Structural	Annually	2 years
native and desired non-native species?	Plant and animal population levels before and after ecological restoration	Guidelines 1-3		
To what extent are RNAs and cRNAs being managed to protect their unique values and how are they contributing to research?	Acres managed to protect unique values	Land Ownership Goal 2; Prescribed Natural Fire Goal 1 (PNF is an outdated term. Appropriate Management Response is current term); Objective 1; Land Ownership Goal 2	Annually	6 years
To what extent are key terrestrial habitat components (e.g., mast, snags, down woody material) being provided?	Number of den and snag trees per acre in managed stands	Vegetation Management Guideline 3; Vegetation Management Structural Guideline 1a, 2a, 2b, 3a, 3b, 3c	Project by project	2 years
To what extent are existing and potential old growth forest stands	Acres of existing and potential old growth by forest type	Vegetation Management Goals 1-3;		_
being managed or unmanaged to develop into or accelerate toward old growth?	Connectivity of old growth system	Objective 1; Guidelines 1-5	4 years	4 years

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
How much even-aged management (especially clear-cutting) should be used? In what forest types should it be used?	Acres of even-aged harvest that emulates natural disturbance regimes, creates wildlife habitat (e.g., jack pine barrens and well-distributed age classes of aspen-spruce-fir mixed stands) and moves toward veg comp goals	Forest Plan 2600-Wildlife, Fish and Sensitive Plant Habitat Management. 2400-Vegetation Management Guideline 1	Annually	2 years

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
Monitoring Element: Status of focal species to assess the ecological conditions required under §219.9 (36 CFR 219.12(a)(5)(iii)).	See below.	2012 Planning Rule Required Monitoring Element	See below.	
Is the type and frequency of disturbance associated with drysand outwash plains (ELT 10/20) appropriate to maintain ecosystem integrity throughout the historical range of variation?	Sharp-tailed grouse population trend	Forest Plan (2600) objective to maintain permanent openings within vegetation composition goals for habitat suitable for sharp-tailed grouse. Provide for KW management within forest-wide vegetation goals. Prescribed fire mimicking natural fires used as a management tool (2400). In MA 4.4 provide wildlife habitat for KW and other upland species such as sharptailed grouse, KW and Black-backed woodpecker. Provide large openings and savanna complexes. Key ecosystem components of dry northern forest/barrens include, frequent fire or management to mimic fire (including timber harvest and prescribed burning), a large number of snags, biological legacies (large red/white pine retained) habitat connectivity resulting in large early successional complexes, pine age-class diversity. Scale: ELT 10/20, primarily on Management Areas 4.2 and 4.4, Forest-wide.	Annually	10 years

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
Monitoring Element: 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 (36 CFR 219.12(a)(5)(iv)).	See below.	2012 Planning Rule Required Monitoring Element	See below.	
To what extent is the management of the Forest contributing to the	Number of TES species for which recovery actions are accomplished	Wildlife Goal 5; TES Goals 1, 3; Standards 1, 2; Guidelines 1-4; Land Ownership Goal 2; Eastern Regional Sensitive Species Framework	Annually	2 years
conservation of threatened, endangered and species of	Acres of habitat improved for TES species			
conservation concern (TES)?	Number of species removed from TES lists		10	10
	TES population trends		10 years	10 years
	Acres of appropriately stocked jack pine for KW habitat (over or under and with appropriate opening percentage)	Lands are adequately restocked as specified in the Forest Plan	Annually	2 years
To what extent is the Forest	Acres of compacted snow.	Wildlife Goal 5; Canada lynx Goal 1;		
maintaining the amount and juxtaposition of Canada lynx	Acres of contiguous habitat connectivity	Guideline 1; TES Standards 1,2;	2 years	2 years
foraging and denning habitats?	Juxtaposition of forage and denning habitat	Guideline 4		
To what extent is the Forest	Number of consultation efforts			
working cooperatively with the U.S. Fish and Wildlife Service, state and other federal agencies to update and implement recovery plans and conservation assessments for TES?	Number of representatives on interagency Recovery Teams	Wildlife TES Goals 3 and 4; Guideline 1	Annually	2 years

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
Monitoring Element: Status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives (36 CFR 219.12(a)(5)(v)).	See below.	2012 Planning Rule Required Monitoring Element	See below.	
What are the effects of OHVs on the physical, biological and social	Acres of habitat impacted by OHV use	Motorized/non-motorized Trails Goals 1-3; Objectives 2 and 4		
environment?	Acres of soil compacted, rutted or eroded by OHV use	Motorized/non-motorized Trails Goals 1-3; Objectives 2 and 4;	Annually	2 years
	Number of water quality erosion sites caused by OHVs	Watershed Management Objective 1; Riparian Ecosystem Standard 1 and Guidelines		
What are the effects of snowmobiles on the physical, biological and social environment?	Acres of habitat impacted by off trail use	TES Goals 2; Guidelines 1-4	Annually	2 years
To what extent is the Forest providing snowmobile opportunities?	Miles of designated snowmobile trails	Motorized/Non-Motorized Trails Goals 1-3; Objectives 2 & 4	Annually	2 years
To what extent is the Forest providing and maintaining a variety of inland lake watercraft accesses in motorized and non-motorized settings?	Number of access sites by setting	Great Lakes and Inland Lakes Access Goal 1; Objective 2	Annually	2 years
To what extent is wilderness being managed to protect the biological and physical resources and wilderness values while accommodating recreational uses?	Number of Wilderness Performance Elements met	Wilderness Goal 1	Annually	10 years
To what extent are Wild and Scenic River values being managed to protect the biological and physical resources while accommodating recreational uses?	Outstandingly Remarkable Values improved	WSRs Goals 1 and 4	Project by project	2 years
What is the status of visitor use and visitor satisfaction?	National Visitor Use Monitoring (NVUM) Metrics	2012 Planning Rule Required Monitoring Element	5 years	6 years

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
Monitoring Element: Measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area (36 CFR 219.12(a)(5)(vi)).	See below.	2012 Planning Rule Required Monitoring Element	See below.	
How are the timing and duration of winter weather conditions changing across the plan area on an annual basis?	Accumulated Winter Season Severity Index (AWSSI). Index is based on data measured on a daily basis: 1. Max temperature 2. Min temperature 3. Snowfall 4. Snow depth	2012 Planning Rule Required Monitoring Element	Daily	2 years

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
Monitoring Element: Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities (36 CFR 219.12(a)(5)(vii)).	See below.	2012 Planning Rule Required Monitoring Element	See below.	
How close are projected outputs and services to actual?	A quantitative and qualitative estimate of performance, comparing outputs and services with those projected by the Forest Plan.	36 CFR 219.12 (a)(5)(vii) Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities. Forest Plan Appendix A	Annually or on a multiple year interval depending on resource	2-10 years
How close are projected costs with actual costs?	Documentation of costs associated with carrying out the planned management prescriptions compared with costs estimated in the Forest Plan.	Documentation of costs associated with carrying out the planned management prescriptions	Annually or on a multiple year interval depending on resource	2-10 years
To what extent is the Forest meeting the vegetative composition objectives?	Vegetative composition percentages by ELTP and MA	Vegetation Management desired condition 1 and 2; Goals 1-3	2-10 years	2-10 years
Has public demand for commodity uses and non-commodity opportunities changed?	By resource, situations that generate resource damage or demand exceeds Forest capacity to provide	Vegetation Management, Forest Products Goals 1-2; Land Uses Management Goals 1-2; Minerals and Geology Goals 1, 4; Recreation, Great Lakes and Inland Lakes Access Goals 1, 3; Recreation Development and Recreation Facilities Goal 1	Annually	2 years
To what extent is the Forest meeting its transportation system objectives?	Miles of roads decommissioned or constructed to be within guidelines			
	Number of effective road closures	7700-Transportation system Goals, Guidelines, and Objectives	. ,	
	Miles of roads reconstructed and bridges constructed and/or reconstructed		Annually	2 years
	Number of culverts replaced			

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
To what extent is timber management occurring on lands suitable for such production?	Acres inventoried by stand exams, walk- throughs, photo interpretation and during project-area analysis	Forest Plan Appendix A	Project by project	2 years
To what extent do output levels, location of timber harvest and mix of saw timber & pulpwood compare to those levels?	The difference between actual output of saw timber and pulpwood and projected output	Forest Plan Appendix A	Annually	2 years
Are harvested lands adequately restocked after 5 years?	Acres meeting required minimum percentages through first-, third- and fifth-year stocking surveys	Lands are adequately restocked as	Annually	2 years
	Acres that fail to meet minimum stocking requirements by silvicultural prescription	specified in the Forest Plan	Aillually	2 years

Monitoring Question(s)	Indicator(s)	Driver	Measurement Frequency	Evaluation/ Reporting Frequency
Monitoring Element: The effects of each management system to determine that they do not substantially and permanently impair the productivity of the land (16 U.S.C. 1604(g)(3)(C)) (36 CFR 219.12(a)(5)(viii)). For purposes of this subpart, a timber management system, including even-aged management and uneven-aged management.	See below.	2012 Planning Rule Required Monitoring Element	See below.	
Are the effects of Forest management, including prescriptions, resulting in changes to the productivity of the land?	Acres of whole tree harvesting on xeric sands	2500 Watershed Management – Soil Resources Goal 2	Annually	2 years
Additional Monitoring Questions				
To what extent is the Forest meeting its Federal Indian trust responsibility, including, but not limited to, meeting the requirements of memoranda of understanding, consulting with tribes on Forest management and actively seeking collaborative opportunities?	Number of notifications and consultations, e.g., documentation of National Environmental Policy Act notifications and consultations, National Historic Preservation Act and Native American Graves Protection and Repatriation Act consultations	Nothing in this Plan or its implementation is intended to modify, abrogate or otherwise adversely affect tribal reserved or treaty guaranteed rights applicable within the Forest. 1500-External Relations Objective 1	Annually	Annually
	Number of consultation meetings			
	Number of collaborative meetings and discussions			
How are Heritage properties being protected from damage or disturbance?	Number of heritage structures and sites protected	36 CFR 79; 36 CFR 800; 43 CFR 3; 43 CFR 7; 43 CFR 10. 43 CFR 7; 43 CFR 10. Compliance with 36 CFR 219.11 (d)	Annually	2-10 years