Hiawatha National Forest

2006 Monitoring & Evaluation Report

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Introduction

The Hiawatha National Forest Land and Resource Management Plan (Forest Plan) was approved for implementation in 2006. National Forest Management Act (NFMA) regulations require the forest to develop and implement a program of Monitoring and Evaluation to determine the effectiveness of active management on resources found on or near National Forest lands (36 CFR 219). Specifically, the monitoring and evaluation plan described in Chapter 4 of the 2006 Forest Plan is designed to answer the following questions:

- Did we do what we said we were going to do?
- Did our standards, guidelines, and objectives work as we expected them to?
- Is our understanding and science correct?

The purpose of monitoring and evaluation is to have the ability 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 or changed conditions.

Monitoring and Evaluation Strategy

Monitoring and evaluation are separate activities. Monitoring is the process of collecting data and information. Evaluation is the analysis and interpretation of the data collected from monitoring activities. A key requirement of the monitoring and evaluation process is for the forest staff to determine how closely Forest Plan standards and guidelines have been applied and how well the Forest Plan objectives are being met. This evaluation is presented in a Monitoring and Evaluation report to the Forest Supervisor, along with any recommended changes, revisions, or amendments to the forest plan deemed necessary (36 CFR 219.12(k)).

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. Minimum legally-required monitoring is defined by NFMA (36 CFR 219).

Fiscal Year 2006 M&E Framework

Monitoring and evaluation under the 2006 Forest Plan was new due to the timing of the 2006 Forest Plan approval (March 2006) and implementation (August 2006). Therefore, this report consists of two parts; a brief synopsis of each of the monitoring and evaluation activities in 2006 and the guidance for monitoring activities to occur in 2007 and beyond.

There were eight key monitoring/evaluation activities selected from the 2006 Forest Plan that are included in this report. These generally represent activities that are

consistent with the 1986 forest plan that had already been scheduled for monitoring. Since the forest plan was implemented in August of 2006, monitoring under the new plan direction was limited. Each of the following monitoring activity descriptions includes the monitoring question to answer, a synopsis of the Forest Plan standards, guidelines, and objectives the question addresses, a brief summary of the data collected, and an evaluation of the activity. Finally, each activity description concludes with a general statement about future monitoring activities.

The final section of this report consists of a more detailed synopsis of the future monitoring and evaluation activities that are expected to occur on the Hiawatha National Forest. Each activity description includes the questions it is meant to address, collection methods, timing, and data storage strategy.

Insects, Disease and Disturbance Processes

Monitoring Question:

To what extent is the Forest managing undesirable occurrences of fire, insect and disease outbreaks?

Monitoring Activity Relationship to Forest Plan:

3400 Pest Management Guidelines 1-2:

1. Integrated pest management methods should be used to minimize the effect or prevent the spread of insect and disease infestations
2. Promote spatial diversity of vegetation and age classes guided by the ecological characteristics of the landscape to reduce the risk of insect and disease damage

Monitoring Activity and Data Collection:

Guideline 2 (above) of the Hiawatha's Forest Plan identifies a desired condition reduce the impacts from invasive species by promoting the forest's health in order to be resilient to the effects of invasive insects, pathogens, plants, animals and other pests. A useful starting point is to assess the insect and disease situation currently on the forest.

Non-native Insects: Other than a few isolated minor occurrences of gypsy moth, no non-native invasive insects were found on the Hiawatha in 2006. The Forest cooperated with Michigan Technological University and with the Michigan Department of Agriculture, each of which established a system of detection trees to determine whether emerald ash borer might be present. Fortunately, all results from these detection trees were negative.

Non-native Disease: Beech bark disease, caused by the interaction of a non-native insect and one or more species of fungus, was detected on the east side of the Hiawatha. This disease was first introduced into North America in Nova Scotia in the 1890s and has been spreading westward since then. This disease is fatal to most larger-diameter beech trees within a few years after the trees become infected. Research has identified characteristics of beech trees likely to be most susceptible to the disease. Preventive measures, mainly the removal of trees with these characteristics, can only be effective before infection occurs in a stand.

Native Insects: Native insects and diseases are normally present in forests at low levels. Periodically, native insect or disease populations may increase to levels that can result in significant damage. Northeastern Area State and Private Forestry, based in St. Paul, MN, conducts an aerial pest detection survey that covers the entire Hiawatha National Forest each summer. This is one of the most important and effective means available to the Forest to identify insect or disease outbreaks.

Large areas of defoliated and/or dead jack pine were the most widespread problem noted in the 2006 detection survey. Forest staff ground-checked the areas identified by the aerial survey and determined that an outbreak of jack pine budworm was responsible. Jack pine budworm is a native insect that is normally present in small numbers that do not cause significant damage. However, its population can build to damaging levels where large numbers of susceptible mature to overmature jack pine are present.

The jack pine budworm outbreak was most concentrated on the west side of the Forest in 2006; the east side was already addressing a jack pine budworm outbreak that had begun a few years earlier. Environmental analysis was already in progress on some of the infested areas to determine which if any areas should be harvested to remove the dead and dying mature and overmature jack pine and replace it with healthy young jack pine that is far less susceptible to budworm.

Evaluation of Monitoring Activities:

Non-native Insects: Monitoring activity showed no significant immediate threat due to non-native insect presence on the forest. There is no immediate response necessary at this time.

Non-Native Disease: The presence of beech bark disease on the Ease side of the forest and the likelihood of its spread to the west side has required mitigation measures in response to Guideline 1 (above). The Hiawatha has begun to address beech bark disease in stand management prescriptions on both sides of the Forest by adopting the recommendations contained in peer-reviewed literature regarding beech bark disease.

Native Insects: The environmental analysis projects identified several areas where jack pine harvest and regeneration were appropriate to meet vegetation composition and forest health goals contained in the Forest Plan (Guideline 2, above). These areas were included in timber salvage sales to be offered in 2007.

Future Monitoring Activities:

Non-Native Insects: For the future, the Hiawatha will continue to cooperate with Michigan Technological University and the Michigan Department of Agriculture to monitor for the presence of emerald ash borer. The Hiawatha will also continue to cooperate with Northeastern Area State and Private Forestry in the aerial pest detection surveys, and the Hiawatha will continue to ground-check possible insect or disease problems and determine how best to address them.

Non-Native Disease: The Hiawatha National Forest will address beech bark disease by continuing to implement peer-reviewed literature recommendations in stand management prescriptions.

Native Insects: The Hiawatha National Forest will continue to evaluate the data collected by Northeastern Area State and Private Forestry for potential jack pine budworm and other insect outbreaks. Appropriate responses will be determined when they are detected.

Social and Economic Stability

Monitoring Question:

To what extent do output levels, location of timber harvest and mix of saw timber and pulpwood compare to the levels projected in the Forest Plan?

Monitoring Activity Relationship to Forest Plan:

Projected timber output levels, location (by Ecological Land Type) and saw timber/pulpwood mix is described in Forest Plan Appendix A.

Monitoring Activity and Data Collection:

In 2006, the Hiawatha National Forest Timber Sale Program sold 63,895 hundred cubic feet (CCF) (39,441 thousand board feet, or MBF) of timber. The 2006 Forest Plan states an Allowable Sale Quantity (ASQ) of 100,009 MBF or 162,014 CCF. Therefore the forest obtained 39.4% of the ASQ as stated in appendix A.

Harvesting activity occurred only on suitable lands as identified in the 2006 forest plan. Approximately 60% of all harvesting occurred within jack pine stands. The remaining 40% of the harvests where located across all districts, land types and species groups (except cedar).

Sawtimber accounted for approximately 14% of total forest timber output. The forest plan projected 62% of the decade 1 timber volume would be sawtimber. Pulpwood accounted for approximately 86% of total forest timber output. The forest plan projected 38% of the decade 1 timber volume would be pulpwood.

Evaluation of Monitoring Activities:

The discrepancy between forest plan projected sawtimber/pulpwood mix and actual output can be atributed to a prolonged jack pine budworm infestation across the forest. The infestation has emphasized the removal of jack pine which is sold primarily as pulpwood. This is consistent with the forest plan which directs aggressive jack pine management in the first decade. Jack pine management will mitigate major budworm infestations over time. Since this trend of intensive jack pine management is expected to decrease relatively quickly (1-2 years), there is need to change the current jack pine management strategy.

Currently much of the sale program involves softwood species. Economically the forest has not balanced its species outputs in proportion to local industry demands. Economically the softwood pulp and softwood lumber mills have mostly benefited over the past 12-18 months. This trend is expected to continue during the 2007 and 2008 calendar years where the forest will produce 60-75% softwood. Yet this is only a short-term trend when compared to the projected decadal outputs in the forest plan. Starting

in FY 2009 the forest will strive for an output mix of 33% softwood, 33% hardwood and 33% aspen which is closer to historic levels.

Future Monitoring Activities:

Data will continue to be collected concerning the type, location and amount of timber sold.

Official timber sale harvesting data is maintained at the Regional level. It is stored in multiple data bases. The Automated Timber Sale Accounting system (ATSA) and the Timber Information Management system (TIM) are two of the more significant data bases which store this information. Quarterly accomplishments are reported upward. The forest receives an official year end report in late October or early November.

Soils

Monitoring Question:

Are the effects of forest management, including prescriptions, resulting in significant changes to the productivity of the land?

Monitoring Activity Relationship to Forest Plan:

2500 Watershed Management Goal #2:
2. Soil productivity is restored, maintained, or enhanced

Monitoring Activity and Data Collection:

The primary effects of Forest management related to soil productivity monitored during FY 2006 were soil compaction and overall soil disturbance. Previous years' monitoring documented that compaction was generally not occurring on sandy soils. Therefore, in 2006, monitoring activity was more heavily focused on finer textured soils (clay and silty clay loam) although some samples were still taken in sandy soil.

Soil Compaction: The method used for soil compaction sampling involved randomly locating line transects in an activity area and extracting intact soil cores from depths of 3-6 inches and 6-9 inches at strategic points along each transect. To assess the impact of the activity on soil compaction, the soil cores were taken from the skid trail closest to a previously selected random distance from the start point of the transect. Only skid trails were sampled because it is assumed that these areas would be the most compacted after logging. In 2006, a total of 62 soil compaction samples were taken from skid trails in three harvest units. These samples were dried to a constant weight at 105°C, sieved through a 2 mm screen to remove coarse fragments, and weighed. Bulk density was calculated by dividing the dried weight soil sample with the coarse fragments removed by the volume of the core minus the volume of the coarse fragments.

Soil Disturbance: Two measurement methods were used to assess the impacts of the harvest on soil disturbance.

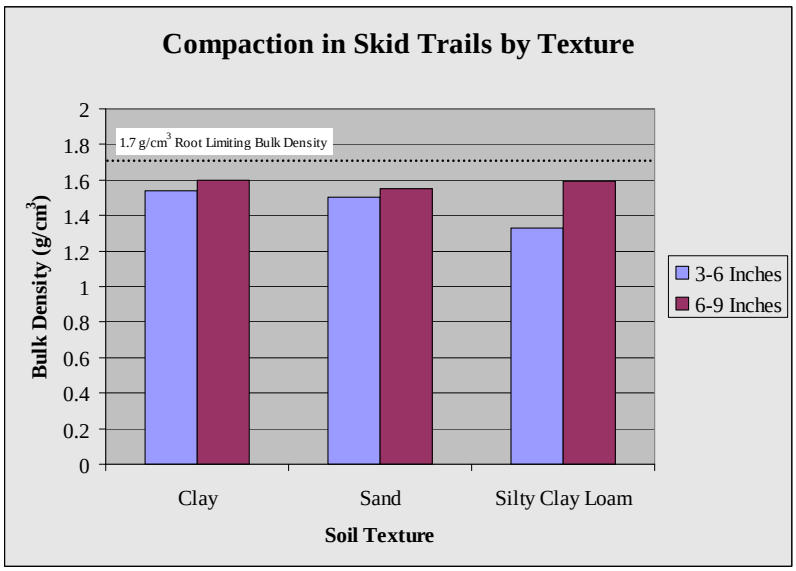
Sixty-two 100 foot transects were randomly established in the three sampled harvest areas. Along each transect, the number of feet of skid trails or other obvious forms of soil disturbance were measured. To illustrate, if a transect intersected a skid trail perpendicularly, roughly 8 feet of the transect was counted as disturbed (the approximate width of the skid trail).

During the winter of 2006, compacted snow and frost/freeze depths were assessed at nine locations to ensure that soils would not be impacted by winter logging in sensitive areas. Requirements established based on literature review of studies in the Upper Great Lakes Region have documented that 12 inches of compacted snow or 6 inches of frost/frozen soil is sufficient to protect soils. The winter harvest locations were studied

to determine inches of compacted snow, inches of uncompacted snow and inches of frost/frozen soil.

Evaluation of Monitoring Activities:

Soil Compaction: In general, management activities are not resulting in compaction above the published root limiting value of 1.7 g/cm3 in any soil type. The graph below shows bulk density at the two studied depths for each of the three types of soil assessed. There were a few samples which were above the root limiting value but most of these were only marginally so and within the error of the methodology. This indicates that management practices are maintaining soil compaction indices within the accepted productivity guidelines, although further studies should be conducted in the future support this conclusion.



Soil Disturbance: From the sixty-two soil disturbance transects, the average distance of disturbance was 9 feet (9.0%) and the standard deviation was 12.8%. However, one of the transects intersected a decking area within the stand/payment unit that caused it to have an irregularly high disturbance value. If this transect is removed from the sample, the average disturbance drops to 7.4% (standard deviation of 5.7%). Regional soil quality standards require that no more than 15% of the harvest area can be disturbed. These results indicate that harvesting practices are well within the allowable disturbance limits.

Of the nine locations assessed for snow compaction and frost/freeze depth, the average compacted snow depth in the skid trails was approximately 10 inches while the adjacent areas had an average of 34 inches of uncompacted snow. Most of the soils had either no or very little frost in the ground. In some places the compacted snow appeared sufficient to protect soil resources; however, in places where there was active near-surface groundwater flow (swales, toe slope, etc.), some rutting was evident. Sale

administrators were able to pull equipment out once rutting occurred. This study indicates that winter harvest requirements need to be revised when there is the presence of near surface groundwater flow, and work has already begun to do so.

Future Monitoring Activities:

In 2007, compaction sampling continued in clay and silty clay loam soils. It is hoped that by the end of FY 07, enough data will have been gathered to make definitive statements regarding soil compaction impacts associated with forest management on finer textured soils with current operational methods. The question will need to be revisited if harvest methods change. Also, in 2007, Best Management Practices and assessment of soil impacts as compared to the R9 Soil Quality Standards began. It is hoped that this additional monitoring and data will help guide future management.

Future monitoring will focus on whole sites meeting the Regional Soil Quality Standards, using both meandering transects to cover the entire site and specific random transects similar to the transect method currently employed.

Transportation

Monitoring Question:

To what extent is the forest meeting its transportation system objectives?

Monitoring Activity Relationship to Forest Plan:

The desired condition is to construct and/or decommission roads to bring all management area road densities to within the guidelines established in the Forest Plan.

Safety on forest roads should be increased by accomplishing critical maintenance items, reconstructing segments which are below standards for safety and creating a more seamless system.

7700 – Transportation System Objectives:

1. In this planning period, reconstruct an average of 10 miles of arterial/collector roads per year.

7700 – Transportation Guidelines:

1. Road reconstruction should follow the existing corridor alignments

Monitoring Activity and Data Collection:

The transportation section of the Forest Plan outlines road density guidelines of miles of road per square mile of management unit. The 2006 existing condition (as of the implementation of the Forest Plan) is shown in Table 1 (taken from Table 3-TRANS-2 of FP 2006). This table also shows the Forest Plan desired condition for each Management Area.

In 2006 a total of 15.05 miles of roads were constructed across the forest, none of which were in management areas 8.3, 6.1, or 6.2. Decommissioning commenced on 3.05 miles of roads. Reconstruction or resurfacing occurred on 7.23 miles of arterial and collector roads along existing corridors.

Evaluation of Monitoring Activities:

In Fiscal Year 2006, there were 6 management areas at or in excess of the desired road density (4.4, 6.2, 6.3, 6.4, 8.1 and 8.2). The location of the constructed roads indicates that the desired road densities in management areas 6.1 and 8.3 were not exceeded and the road density in management area 6.2 was not further raised above the desired level. Overall, there was a net forest-wide gain of 12 miles (0.28%) over the existing condition in the forest plan. Construction and reconstruction activities were spread across multiple management areas and therefore resulted in a negligible change in road densities in the management areas where these activities occurred. Reconstruction

activities generally followed existing corridors except for those circumstances where roads were realigned to improve user safety.

Table 1: Road Density Existing Condition (2006) and Forest Plan Desired Condition

MA	Miles of Roads	Road Density (mi/sq mi)	Desired Condition (mi/sq mi)
1.2	188	1.2	3
2.3	1233	3.8	4
4.2	726	3.7	4
4.4	762	4.3	4
4.5	416	2.3	2.5
5.1	36	0	No Roads Allowed
6.1	22	1.2	2
6.2	93	3.4	2.5 (1.5 open)
6.3	13	3.2	0
6.4	190	2.6	2.5 (1.5 open)
7.1	17	0	no limit
8.1	39	1.6	1
8.2	38	4.2	4
8.3	263	1.6	2
8.4	87	0	not specified
8.5	109	0	see Forest Plan Ch. 3
Total	4232		

Future Monitoring Activities:

Future monitoring will involve data collection on miles of roads built, decommissioned, and reconditioned/reconstructed. This data will include management areas where the activities occur so that road densities can be evaluated at the management area level. Since miles of roads treated (built, reconstructed, or decommissioned) is small on a yearly basis relative to the total miles of inventoried roads on the forest, cumulative totals over several years should be used in the future to recognize trends or effects of the transportation program. Data collection includes the road name, work done, and miles of work accomplished and is stored in the INFRA database. No changes to data storage are necessary.

Timber Regeneration

Monitoring Question:

Are harvested lands adequately restocked after 5 years?

Monitoring Activity Relationship to Forest Plan:

2400 Vegetation Management Reforestation/Silvicultural Practices Guideline 2:

> 2. Reforestation of harvest areas through natural regeneration or seeding should be emphasized. Interplanting to restore components of the ecosystem which are in decline or absent should be allowed.

Monitoring Activity and Data Collection:

Stands treated with regeneration harvests, such as clearcuts, seed tree cuts, shelterwood cuts, or selection cuts, must be reforested within five years of harvest under the National Forest Management Act (NFMA). Reforestation may be through natural regeneration with or without site preparation, or through artificial means such as planting seedlings or applying seed. Reforestation activities are scheduled as soon as possible after harvest. Any needed site preparation in usually done in the first field season following harvest. If seeding is planned, that activity usually takes place on snow in late winter following site preparation. If planting is planned, that activity is usually scheduled for the spring following site preparation.

Stands are surveyed at least twice following reforestation activities to monitor reforestation success and ensure that reforested stands are restocked with an adequate number of young trees to meet management goals. Stocking surveys are usually conducted in the first and third years following reforestation activities; additional surveys may be scheduled in some stands.

A minimum of five plots is taken in each stand surveyed, with the number of plots increasing as stand size increases. Plot locations are distributed throughout the stand to ensure that all areas of the stand are surveyed. While walking between plots, the surveyor also notes whether overall regeneration stocking is similar to the results in the plots. Stands where regeneration stocking is lower than desired for that stand's management goals will be scheduled for additional reforestation activities, usually supplemental planting.

Approximately 3,600 acres were scheduled for third-year or later stocking surveys in 2006. All of the acres requiring stocking surveys were evaluated. Of these, about 3,300 were certified as regenerated with sufficient stocking.

Evaluation of Monitoring Activities:

There were approximately 300 acres that were not certified as regenerated with sufficient stocking based on results of third-year or later surveys in 2006. These stands were scheduled either for supplemental planting in 2007 or for one additional survey to determine whether supplemental planting would be needed.

It is likely that there will always be a relatively small percentage of stands where the initial reforestation activity will need to be supplemented to some degree. The Forest has experienced several years with extended periods of dry weather during the growing season, which often results in some seedling mortality. Even when weather conditions are favorable, other factors such as deer browsing, insects, or disease may sometimes result in a need for additional reforestation efforts. Current reforestation methods and activities are adequate to fulfill the NFMA reforestation requirements and no changes are needed.

Future Monitoring Activities:

Reforestation success will continue to be monitored through stocking surveys for all stands now in the process of regeneration, as well as for stands harvested and reforested in the future, to ensure that harvested stands are adequately reforested within five years. Where needed, supplemental reforestation activities will be carried out to ensure this goal is met within the required time period.

Non-native Invasive Species

Monitoring Question:

How effective is the Forest at treating and controlling the spread of non-native invasive species?

Monitoring Activity Relationship to Forest Plan:

2500 Watershed Desired Conditions:

"Exotic species are not spreading or adversely affecting native flora and fauna in riparian and aquatic areas"

3400 Pest Management Goals:

1. Work with state, local, tribal, other agencies and organizations to discourage the spread of undesirable non-native species
3. The spread of existing non-native invasive species is controlled using permissible mechanical, biological and chemical controls
4. Educational materials about controlling and/or reducing the spread of non-native invasive species are developed and distributed at appropriate locations including boat launches, trailheads, etc.

3400 Pest Management Objectives:

1. In this planning period, identify and map areas of non-native invasive species concentration on the forest
2. Annually treat 40 acres of identified non-native invasive species

3400 Pest Management Guidelines:

1. Integrated pest management methods should be used to minimize the effect or prevent the spread of insect and disease infestations
2. Promote spatial diversity of vegetation and age classes guided by the ecological characteristics of the landscape to reduce the risk of insect and disease damage
4. Gravel and topsoil should be from a source where weed reduction practices are being used

Monitoring Activity and Data Collection:

NNIS monitoring for 2006 consisted of visual monitoring with photography and garbage bag counting. The Hiawatha NF participates in a weed cooperative with several other agencies including The Nature Conservancy, Superior Watershed Partnership, National Park Service, and the Marquette County Conservation District. Some sites were monitored with the help of The Nature Conservancy. Additionally, volunteers helped to treat and monitor approximately 45 acres.

Visual monitoring with photography involves taking photos at reference locations in weed treatment sites. This allows managers to look at sites and judge qualitatively

whether treatment is having a positive impact. Additionally, future managers can refer to photos to compare present condition with past condition. Visual monitoring will be useful when treating populations with treatment methods other than pulling such as herbicide, mowing, or tarping. In 2006, 37 sites (51.7 acres) were photographically monitored.

Garbage bag counting is a method used to determine how effective NNIS treatments are at given sites. At approximately the same time each year, sites are treated with hand pulling to remove 100% of the weeds at those sites. Pulled plants are placed in 55-gallon garbage bags which are counted when they are removed from the site. The number of bags can then be used to estimate the amount of weed biomass removed at a given site every year. Between-year trends can be used to indicate the long-term effectiveness of the treatments. In 2006, 37 sites (51.7 acres) received garbage bag count monitoring. At Williams Landing and Trout Bay Road on Grand Island, NRA, 12 bags of St. Johnswort and spotted knapweed were removed.

Evaluation of Monitoring Activities:

Results from the photographic monitoring show that weeds are decreasing at some sites due to the NNIS removal treatments applied at those sites.

Results from bag counting also show a distinct downward trend in biomass removed at selected NNIS sites. An example of this downward trend is presented from Williams Landing and Trout Bay Road on Grand Island NRA from 2003-2006 (see Figure 2). During this time period there was an 83% decrease in the assumed biomass of NNIS growing at the site.

This downward trend indicates that treatments are effective given that there are fewer plants to treat. This creates opportunities to expand treatments to different species and/or sites. Spotted knapweed (*Centaurea bieberstienii*) plant numbers have been reduced on Grand Island sites, and the HNF has now been able to move on to treating additional non-native invasive species such as *Hypericum perforatum* and *Cirsium palustre*.

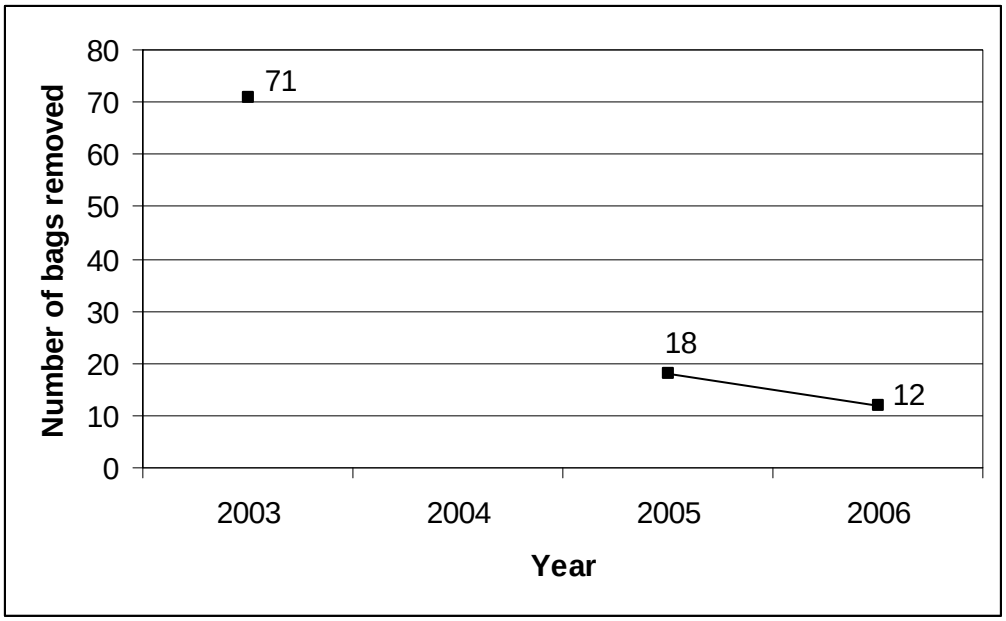


Figure 2: Bags removed from Williams Landing and Trout Bay Road on Grand Island NRA

Future Monitoring Activities:

Future monitoring will consist of recording treatment effectiveness on 50% of all acres of NNIS treatments in that year. Treatment effectiveness will be measured with ocular estimates of the percentage of plants killed. This will be similar to photography in being particularly useful for measuring effectiveness in treatments such as herbicides, biocontrol, and mowing. The HNF will continue to use photography monitoring and bag counting to provide additional information on the effectiveness of the treatments. Results from monitoring activities will be entered into the NRIS database.

Heritage Resources

Monitoring Question:

How are Heritage properties being protected from damage or disturbance?

Monitoring Activity Relationship to Forest Plan:

2300 Recreation Management Heritage Resources Goals:

1. Heritage resources are identified, evaluated, preserved and enhanced

Objectives:

4. In this planning period, decrease the number of heritage resource sites that do not meet national management standards.

Monitoring Activity and Data Collection:

Heritage resource monitoring focuses on identifying the sites most threatened with damage or disturbance and the processes that pose the greatest threat to these resources. To accomplish this, a sample of known archaeological site locations was field checked in FY2006. Sites were chosen in order to minimize travel costs and maximize the number of sites that could be visited relative to the field time available. Since sites were selected on an opportunistic basis they are not necessarily representative of the total number of sites on the forest.

In 2006 a total of 58 sites were visited for the purposes of monitoring. This represents about 3.8% of the heritage resource sites on the Hiawatha National Forest. The sites checked consisted of 19 pre-European Native American sites and 29 historic period sites such as logging camps, homesteads, etc. At 31% of the sites some evidence of damage was observed. The cumulative severity of damage was subjectively rated as heavy (5%), moderate (22%), or slight (4%). Sites with slight and moderate damage usually still possess significant potential value, and usually are being impacted by activities that span many years and gradually accumulate damage. Although some signs of recent damage were observed, much of the disturbance noted has occurred over at least several decades. Consequently, annual rates of damage would be much lower than 31%. The sources of damage consist of natural erosion (7%), recreation use (12%), recreation construction (2%), and vandalism (10%). Vandalism includes unauthorized digging by relic hunters. Very little evidence was seen of damage to sites from authorized earth-disturbing projects, such as road construction or timber sales.

Evaluation of Monitoring Activities:

Based on the monitoring of sites in and near earth-disturbing activities on the Hiawatha National Forest, there is no need to revise any of the practices or guidelines concerning heritage resource protection. The management direction and mitigation measures described in the forest plan are effective in preventing undue resource damage.

An active monitoring program in itself can at least partially mitigate some the lower intensity effects of these processes, some of which are very difficult to control. The presence of a forest service employee during a monitoring activity has a small effect on discouraging would-be vandals. Additionally, the information recorded during the monitoring activity, while not physically protecting the site, preserves the information and knowledge that the site holds. Mapping and recording threatened sites and collecting surface artifacts at greatest risk of loss or destruction preserves at least some of the information the site contains.

Future Monitoring Activities:

Results of 2006 monitoring activities will be used in conjunction with other data to prioritize future projects designed to reduce damage or disturbance rates. Future projects include prioritizing sites for more frequent monitoring, preservation/protective measures such as site closure, law enforcement actions, informational posting, test excavation for National Register of Historic Places evaluation, or phase 3 data recovery, based on significance and the degree of risk a site faces.

Data collection and storage is done in several formats. Field notes, site forms, and sketch maps were utilized to document findings. Locations examined were also mapped using resource grade GPS. Monitoring information is being entered into the Heritage Site database in IWEB.

Threatened and Endangered Species

Monitoring Question:

To what extent is the management of the Forest contributing to the conservation of threatened, endangered and sensitive species?

Monitoring Activity Relationship to Forest Plan:

2600 Wildlife, Fish and Sensitive Plant Habitat Management Goals:

1. Diverse, healthy, productive and resilient habitats for aquatic and terrestrial wildlife are provided

Federal Threatened and Endangered Species and Regional Forester Sensitive Species Goals:

1. The Hiawatha National Forest contributes to the conservation and recovery of federal threatened and endangered species and works cooperatively with U.S. Fish and Wildlife Service, Tribes, and other state and federal agencies and recovery teams to update and implement threatened and endangered species recovery plans and management strategies.
2. The Hiawatha National Forest contributes to the conservation of Regional Forester Sensitive Species and works cooperatively with state and federal agencies to complete and implement conservation assessments and strategies.

Threatened and Endangered Species Monitoring Framework:

Wildlife monitoring on the Hiawatha National Forest (HNF) was done in compliance with requirements outlined by the 2006 Forest Plan. U.S. Fish and Wildlife Service annual monitoring and reporting requirements for threatened and endangered species (T&E) also influenced the extent of monitoring efforts on the HNF. Forest Service (FS) personnel, volunteers, contractors, and Michigan Department of Natural Resources (MDNR) personnel accomplished the monitoring. The annual monitoring program is designed to establish baseline information or continue established monitoring protocols, practices that will enable staff to evaluate ecological conditions and trends on the HNF. The following paragraphs include a monitoring and evaluation report for each of the species/groups that were monitored during 2006. Threatened and endangered species require continued monitoring. Regional Forester Sensitive Species (RFSS) reported here are those that had concerted survey efforts in 2006. These species/groups with significant monitoring activity during 2006 were:

Piping plover - Charadrius melodus (endangered)
Gray wolf – Canis lupus (endangered)
Canada lynx – Lynx canadensis (threatened)
Kirtland's warbler – Dendroica kirtlandii (endangered)
Hine's emerald dragonfly – Somatochlora hineana (endangered)
Bald eagle – Haliaeetus leucocephalus (threatened)
Sharp-tailed Grouse – Tympanuchus phasianellus (RFSS)
Raptors – Northern goshawk (Accipiter gentilis) and red-shouldered hawk (Buteo lineatus) (RFSS)

Piping plover - *Charadrius melodus* (endangered)

Monitoring Activity and Data Collection:

Forest Service personnel and volunteers conducted nest monitoring and coordinated with US Fish and Wildlife Service and the Michigan Department of Natural Resources (DNR). Periodic monitoring along the Great Lakes shoreline began April 15, 2006. Comprehensive monitoring began May 1, 2006 and ended August 31, 2006. Nine pairs of piping plovers established territories on HNF lands, all on the East side of the forest. Of the nine pairs, seven pairs produced nests, and five of those pairs fledged young. Of 23 hatched eggs, twelve chicks fledged (Figure P-1). A pair was observed at Indian Point and another west of the Brevort River mouth, but no nests for these pairs were located. None of the failed nests or young mortality was attributed to nest protection or non-compliance of leashed pets or areas closures. Personnel routinely patrolled occupied habitat monitoring exclosure compliance and informing the public about threats to piping plovers and requirements for leased pets.

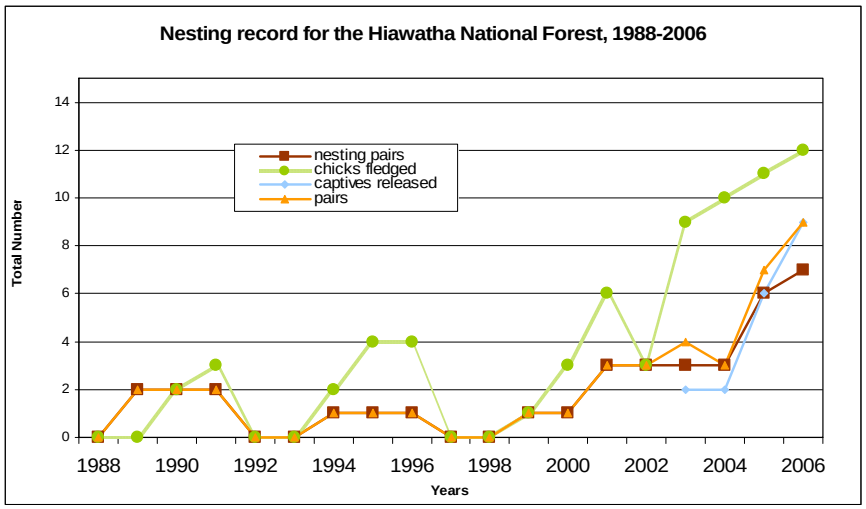


Figure P-1. Summary of piping plover nesting on the HNF

Evaluation of Monitoring Activities:

Trend lines for number of pairs nesting on the HNF and the number chicks fledged suggest the population of piping plovers is increasing. The extensive nest protection and surveillance being conducted by staff and volunteers required to achieve these results indicates there is a link between continued FS management and recovery of the species on the HNF. Therefore, implementation of current monitoring activities and management practices should be continued.

Gray wolf – *Canis lupus* (endangered)

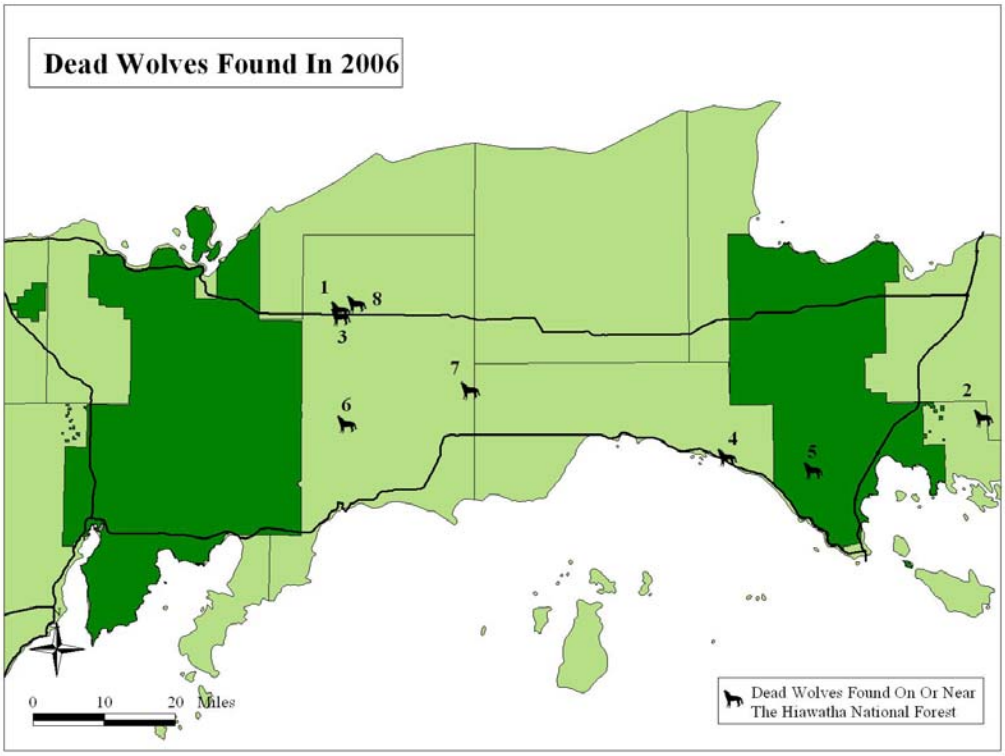
Monitoring Activity and Data Collection:

Michigan DNR personnel conducted monitoring activities for gray wolf mortalities. Wolf mortalities can be used to assess the overall effectiveness of gray wolf management. A total of 8 wolf mortalities were documented over the period from March-December, 2006 (Table W-1). There were 2 females, 5 males, and 1 unknown. Road kill was listed as the cause of mortality for three of the wolves. One of the three road kills (Record 5) occurred on the HNF land. The other two (Records 1 and 3) were located outside of the Forest boundary (Figure W-1). One vehicle related death for the HNF is below the one percent of the annual population threshold indicated in the Biological Opinion issued by the Fish and Wildlife Service for the HNF. The total wolf population in Michigan's Upper Peninsula was 405 individuals in 2005. This represents an increase of 45 from 2004 (13%) and an increase of 395 since 1990 (3950%) (Michigan DNR 2007).

Table W-1. Dead wolves found on or near the HNF as reported by Michigan DNR for the period March through December 2006.

RECORD	ID	SEX	COUNTY	TOWN	RANGE	SECTION	CAUSE OF DEATH
1	Uncollared	Unk	Schoolcraft	46	-16	25	Road Kill / Mange
2	Uncollared	Female	Mackinac	43	-1	13	Possible Poaching
3	2112	Male	Schoolcraft	46	-16	36	Road Kill / Mange
4	7705	Male	Mackinac	42	-7	12	Poaching
5	Uncollared	Male	Mackinac	42	-5	24	Road Kill
6	7708	Female	Schoolcraft	43	-15	18	Mange
7	7711	Male	Schoolcraft	44	-13	24	Mange
8	7718	Male	Schoolcraft	42	-15	17	Poaching

Figure W-1. Location of dead wolves near or on the HNF for the period March through December 2006.



Evaluation of Monitoring Activities:

The trend for wolves across Michigan indicates that current conditions are benefiting the species. Mortality on the HNF appears to be low. This is possibly due to a combination of relative low numbers of wolves and low traffic density across most of the Forest. However, discovery of wolf mortality is opportunistic, rather than systematic and actual mortality on the Forest may be higher than that being documented. Based on this information there is no reason to change the implementation of wolf management on the Forest.

Canada lynx – *Lynx canadensis* (threatened)

Monitoring Activity and Data Collection:

Staff on the HNF conducted 388 miles of furbearer surveys on the HNF in 2006. These consisted of 47 miles of Michigan DNR furbearer survey routes and 341 miles of project area transects. Surveys were completed in winter within a certain period of time after snowfall. Fresh snow makes it easier to identify the species. Snowmobiles were used to access routes and transects. The survey provides a means to identify species in areas that are infrequently observed. Survey routes were both random and non-random. The methods used for both types of surveys are adequate to detect lynx and observers are knowledgeable regarding characteristics of lynx tracks and other field signs for the species. There were no confirmed or potential lynx tracks observed. There were no individual Canada lynx documented by HNF staff. There were also no reports from the other agencies or the public regarding lynx sightings in 2006. There were no occurrences of incidental take, injuries or any known mortality of lynx on the Forest in 2006.

Forest staff monitored areas for cross-country over-the-snow snowmobile travel detrimental to certain wildlife species. Consequently, two areas were designated and signed as closed to snowmobiles, primarily to mitigate potential impacts to sharp-tailed grouse.

Evaluation of Monitoring Activities:

The lower level of compacted routes due to the cross-country snow mobile closure could have benefited lynx. However, the trend for lynx presence on the HNF is unknown. Current low intensity monitoring coupled with suspected infrequent presence of the species on the Forest does not make trend analysis possible. Management practices used on the forest were determined to be beneficial to any lynx present in the area. Therefore, these management activities should continue without modification.

Kirtland's warbler – *Dendroica kirtlandii* (endangered)

Monitoring Activity and Data Collection:

Monitoring and inventory was conducted using field census and compilation of database information. Two key metrics were monitored; breeding habitat and actual bird population. Hiawatha FS personnel and volunteers conducted all monitoring activities in 2006.

Breeding Habiatat: Potential breeding habitat is identified as jack pine aged 6-16 years old on Ecological Land Type (ELT) 10/20 (dry sandy outwash plains). Based on an analysis of the HNF vegetation layer in GIS, there are approximately 7,684 acres of potential breeding habitat for KW on the forest in Management Areas 4.4 and 4.2. These Management Areas (MAs) were chosen due the forest plan direction to maintain KW breeding habitat on these two MAs. Of the total acreage, approximately 5,808 acres are located on MA 4.4 and 1,876 acres are located on MA 4.2.

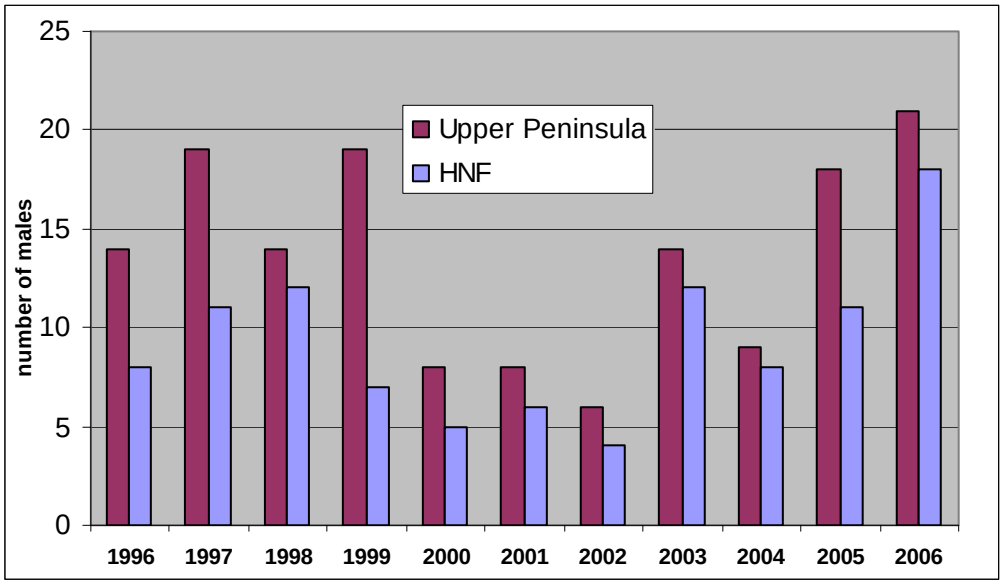
Suitable breeding habitat has the additional attribute of a stocking density of at least 1,089 trees per acre. Currently forest data does not include information regarding stocking density. We suspect the actual acreage of suitable KW breeding habitat is a subset of the 7,864 acres because all jack pine stands fitting age-class, ELT and MA criteria probably do not meet the minimum stocking density. However, there may be stands outside of the 7,864 acres that are suitable breeding habitat. There were stands surveyed in 2006 older than 16 years that contained breeding habitat or were occupied by birds (e.g. Comp. 56, Stand 14 has a year of origin 1989, which is 17 years old). There may also be suitable habitat outside of this ELT and these Management Areas. This could result in an upward adjustment in suitable KW habitat from the 7,684 acres derived from the query. We are currently collecting information that will help us determine suitability more accurately.

Management direction for KW in the 2006 Forest Plan is to provide a continuous 6,700 acres of jack pine suitable for KW breeding. Management activities conducted by the Forest that address that goal include, (1) acres of jack pine sold that will be regenerated to KW stem density and openings criteria, and (2) acres of completed reforestation stocked to KW stem density. In 2006, 1048 acres of jack pine were sold in stands to be regenerated for KW. This is similar to the 1151 acres sold in 2005. In 2006, 532 acres were regenerated to KW breeding habitat criteria, up from 155 acres sold in 2005. Together, sold acres and regenerated acres can be used to assess the likelihood of future KW habitat on the forest.

Bird Population: Forest staff and volunteers conducted the annual KW census on the HNF in 2006 (Figure K-5). The census was conducted by driving or walking through known and mapped potential KW habitat and listening for or observing the number of singing males present. Singing males are counted because they are both easily observable (by their call) and occupy distinct non-overlapping territories. Females are more secretive and do not defend a territory. Total singing males can be used to calculate the total KW population. The 2006 survey counted 18 singing males on the

HNF which accounted for 86% of the total UP population. Nine female Kirtland's warblers were also observed during the surveys, indicating the likelihood that successful nesting is occurring. There was no known KW mortality on the Forest in 2006. The results indicate that the species is stable to slightly increasing on the Forest.

Figure K-5. Kirtland's warbler (KW) singing males on the HNF and Michigan's Upper Peninsula (U.P.).



Evaluation of Monitoring Activities:

In 2005, there were a total of 1316 acres of future KW breeding habitat created (sold plus regenerated). In 2006, this number increased to 1580 acres for an average 1448 acres between the two years. This is more than double the goal outlined in the forest plan of 670 per year. If this trend continues, the forest will have more than 14,000 acres of KW breeding habitat in 15 years. However, most of the recent habitat creation has been in conjunction with the intensive harvests done in response to the jack pine budworm outbreak. This problem is expected to be controlled by 2009, and therefore the trend in KW breeding habitat creation is expected to drop closer to the levels projected in the forest plan.

Implementation of the conservation recommendation for KW is an ongoing process. The forest staff is currently in the process of reviewing jack pine harvest, supplemental seeding, site preparation and slash treatment techniques to determine if additional efficiencies can be achieved for regenerating jack pine management for KW breeding habitat.

Based on the 2006 monitoring information there is no reason to change any of the management practices for this species.

Hine's emerald dragonfly – *Somatochlora hineana* (endangered)

Monitoring Activity and Data Collection:

Monitoring for Hine's emerald dragonfly (HED) was conducted by HNF staff, contractors, and officials from other land management agencies. Suitable habitat was identified from site observations, aerial photography, and soil maps. Sites identified as having elements of suitable habitat were field checked for presence of HED during the summer when adults are flying and more easily observed.

One contractor surveyed approximately 770 acres of potential habitat on the Eastside of the HNF in July-August, 2006[1]. He observed one adult male in a known location (Castle Rock site). The dead specimen was preserved. A different contractor surveyed approximately 1,100 acres of potential *Somatochlora spp*. habitat on the west side of the HNF in July-August, 2006[2]. The survey included dragonflies in the same genus as HED. No HED were observed.

On July 13-14, 2006, a HED workshop/field survey was conducted in the eastern Upper Peninsula., and included representatives from the US Forest Service, Michigan DNR and US Fish and Wildlife Service. Selected sites of the 11 known locations and other suitable habitat were surveyed. Sites without known occurrences of HED where selected because they had elements common to occupied sites. All sites surveyed were checked for adults and evidence of reproduction. No new HED sites were documented during the workshop, but one HED adult was found by USFS personnel along the south shoulder of State Road 123 in Mackinac Co. on July 14, 2006. It is suspected to have been killed by a vehicle. Personnel from the USFWS in the East Lansing Office were notified. The USFWS is notified because they are partners in protection and conservation of HED. It is also a requirement of the incidental take statement in the biological opinion for the HNF Forest Plan.

Evaluation of Monitoring Activities:

There are 11 known locations for the HED on the Forest, all on the eastside. The extent of presence on the Forest is unknown. Surveys on the west side for HED have not yielded any observations. It's possible that the species is very rare on the Forest with few locations yet undiscovered. Future surveys may focus on substantiating breeding in locations were only presence has been documented, as well as locating new sites. The 11 known sites are protected from disturbances.

[1]listed on Everett (Tim) Cashatt's permit-TE842313-14
[2]listed on Everett (Tim) Cashatt's permit-TE842313-14

Bald eagle – *Haliaeetus leucocephalus* (threatened)

Monitoring Activity and Data Collection

Monitoring was conducted by volunteers, FS staff and Michigan DNR personnel. Monitoring activities included breeding/population surveys and human disturbance surveys.

There were 35 bald eagle territories observed on the Forest in 2006 (Tables BE-1 and BE-2). A territory is an area protected by a pair of bald eagles. There were 17 territories observed on the West side of the HNF (Table BE-1) and 18 on the East side of the HNF (Table BE-2). All known territories were visited during the 2006 nesting season. Of the total, there were 21 active territories documented where nesting occurred. This is an increase of 6 from the 15 documented in 2005. There were 15 successful territories (71%) that fledged at least one young. Twenty-three young fledged from the 15 nests (1.5 young per nest), an increase from the 18 young from 11 nests fledged in 2005 (1.6 young per nest).

Six active territories were apparently unsuccessful at fledging young, (29% of the active territories). None of the unsuccessful nests were known to have resulted from HNF active management activities. There were no known instances of partial nest failure. There was no known bald eagle mortality on the HNF in 2006.

There was one known incident of unauthorized Off-Highway Vehicle (OHV) activity in a bald eagle nesting territory on the Forest in 2006. It occurred on the Manistique District where an unauthorized user-developed OHV trail was traversing forest lands within the established bald eagle nest buffer. HNF personnel installed signs and trees were felled outside of the nest buffer zones to discourage use. Subsequent surveillance and monitoring at the location indicated the nest was successful. The OHV use was discontinued.

Table BE-1. West side bald eagle nest activity/productivity summary for nests on the HNF.

Year	Total Territories	Active Territories	Successful Territories	Young
2004	18	11	8	10
2005	19	9	6	12
2006	17	11	8	11

Table BE-2. East side bald eagle nest activity/productivity summary for nests on the HNF.

Year	Total Territories	Active Territories	Successful Territories	Young
2004	6	6	2	3
2005	8	6	5	6
2006	18	10	7	12

Evaluation of Monitoring Activities:

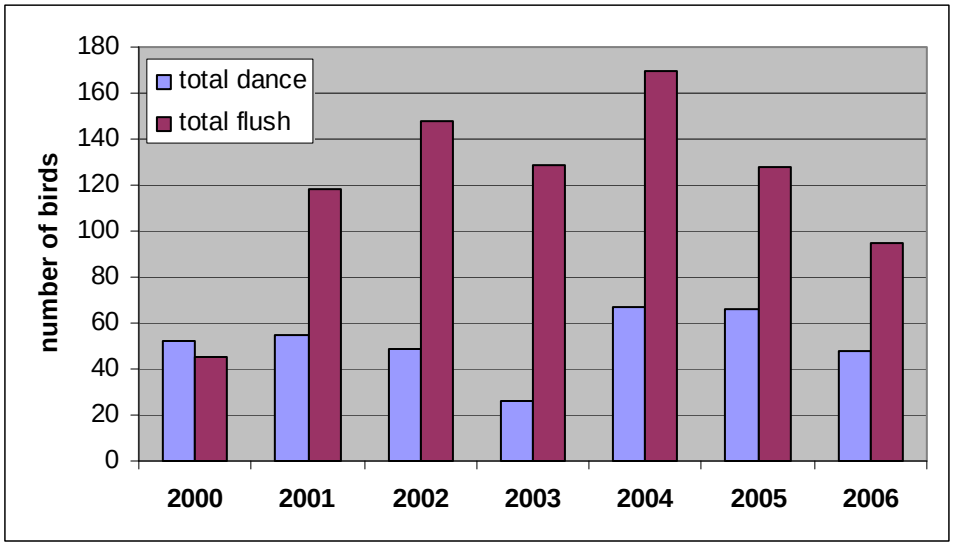
Based on the monitoring data collected in the past three years, the bald eagle population on the HNF appears to be stable on the west side of the forest and slightly increasing on the east side. Monitoring efforts should continue to survey for active nests and document nesting success, as well as note any disturbance activities from either HNF management or other human uses (such as OHV trails). Based on the results of monitoring no changes in bald eagle management are recommended.

Sharp-tailed Grouse – *Tympanuchus phasianellus* (RFSS)

Monitoring Activity and Data Collection:

Monitoring was conducted by FS staff and volunteers at 29 leks across the Forest. A lek is the location where males and females are concentrated during the breeding season. Lek habitat is critical to the success of local grouse populations. These locations are selected for surveys because adult sharp-tailed grouse can be readily observed and counted there. The number of dancing males and the number of flushed individuals was counted at each of these locations. Survey results indicate 2 years of decline in the sharp-tailed grouse population on the Forest from 2004-2006. The total number of dancing males decreased 27% to 47 from 2005 results, and total flushed also decreased by 27% to 95 individuals (Figure S-1). Only 4 dancing males were observed on the west side of the Forest in 2006.

Figure S-1. Sharp-tailed grouse lek counts on the HNF, 2000 – 2006.



Monitoring efforts detected the presence of cross country snowmobile use in close proximity to two of the known leks. Grouse are known to flush from snow burrows when snowmobiles pass. Flushing results in greater energy expenditure and possible loss of fitness which in turn increases mortality. It also exposes the species to higher levels of predation. Consequently, FS staff closed 2 roads and the surrounding off-road areas to snowmobiles.

Evaluation of Monitoring Activities:

Snowmobile activity should be monitored in the two closed areas to determine whether the closures were effective. Sharp-tailed grouse populations should also be monitored in these areas to ensure that the closures had the desired effect on preserving the grouse population. Known leks should continue to be monitored for detrimental snowmobile activity.

It is possible the birds are utilizing leks that are not currently known Increased monitoring activity may be needed to detect the presence of unknown leks.. This would provide more information to determined population trends for this species on the HNF. Kirtlands's warbler management in jack pine may benefit sharp-tailed grouse, especially on the west side where the budworm salvage sales have been concentrated for several years. Future monitoring of the KW management activities should be done to determine the effects on sharp-tailed grouse populations.

Raptors – Northern goshawk (*Accipiter gentilis*) and red-shouldered hawk (*Buteo lineatus*) (RFSS)

Monitoring Activity and Data Collection:

Monitoring for raptors was conducted by HNF staff and contractors in partnership with the Michigan Natural Features Inventory (MNFI). They include the information in their database, which is accessible to Forest Service personnel. A combination of leaf-off surveys and broadcast calling were used to detect raptors. The survey involves walking transects in suitable habitat and playing and taped call for various raptors at specific intervals. If there is a raptor present, the assumption is that it would respond with a call or movement to or away from the observer. In 2006, northern goshawk, red-shouldered hawk and red-tailed hawk calls were used. Surveys began in April and ended in late June.

A total of 216 nests were surveyed. This is a representative sample, since the entire Forest is not surveyed in any year. Raptor use included 35 known nests representing 6 species (Tables R-1 and R-2). There were 18 red-shouldered hawk nests documented, 15 of which were on the East side. There were 9 northern goshawk nests, all of which were thought to have produced young. On the East side, there were 2 active northern goshawk and 8 active red-shouldered hawk territories where the occupied nest could not be found. On the West side, there was 1 active territory each for northern goshawk, red-shouldered hawk and broad-winged hawk where the occupied nest could not be located. Five nests, all red-shouldered hawks, failed for unknown reasons.

Evaluation of Monitoring Activities:

The active nests disparity between each side of the HNF is noteworthy, since it is generally believed habitat for raptors is widely distributed across the HNF. Future analysis will investigate possible explanations.

Table R-1. Raptor survey results for 2006 nesting season on the Eastside of the HNF (n=118 nests).

Species	Active - Breeding	Active - Failed	No. Young
Broad-winged hawk	0	0	0
Cooper's hawk	1	0	1
Great horned owl	1	0	2
Northern goshawk	7	0	14
Osprey	1	0	1
Red-shouldered hawk	15	5	28
Red-tailed hawk	2	0	1
Unknown	0	0	0
Total	27	5	47

Table R-2. Raptor survey results for 2006 nesting season on the Westside of the HNF (n=98 nests).

Species	Active - Breeding	Active - Failed	No. Young
Broad-winged hawk	0	0	0
Cooper's hawk	0	0	0
Great horned owl	0	0	0
Northern goshawk	2	0	5
Osprey	1	0	Unknown
Red-shouldered hawk	3	0	3
Red-tailed hawk	2	0	2
Unknown	0	0	0
Total	8	0	10

Appendix to the 2006 Monitoring & Evaluation Report

Monitoring Guide

Insects, Diseases and Fire Disturbance Processes

Monitoring and Evaluation Question:

To what extent is the Forest managing undesirable occurrences of fire, insects and disease outbreaks?

Descriptions:

Monitoring will allow assessment of the effectiveness of vegetation management activities in reducing the occurrence of insect and disease outbreaks and reducing wildfires. Monitoring will allow validation of the EIS modeling to predict insects and disease occurrences.

Monitoring Indicator:

Occurrence of insect and diseases infestations or outbreaks and wildfires.

Resource Keywords:

Vegetation, Insects, Diseases, Epidemics, Natural Disturbance, Aspen, Jack Pine, Balsam Fir, Mature forests, wildfire

Reference and Driver:

LRMP p. 2-22, 3400 Forest Pest Management, Guidelines 1 & 2.

Destructive insects and disease organisms do not increase to potentially damaging levels where such increases would be a predictable result of activities either performed or deferred as part of a management decision.

LRMP, p. 4-4, Chapter IV, Table 4-3. Monitoring Items.

Rationale and Explanation:

LRMP vegetation desired condition and vegetation composition objectives were developed to provide a diverse, productive, healthy and sustainable forest that is resilient to natural and human-caused disturbances. Vegetation composition and structure provide plant and animal species habitat, timber products and settings conducive to recreation activities. The Hiawatha National Forest is maturing, with short-lived species like aspen, jack pine and balsam fir becoming over mature and thus more susceptible to insects and disease.

Sampling Variables or Parameters:

Acreage by disturbance agent.

Authority:

Required by the LRMP.

Sampling Protocol (method / design):

100 percent detection and mapping of significant insect and disease outbreaks on all Hiawatha NFS lands.

Mapping of each wildfire location and determining acreage by GPS.

Sampling Unit of Measure:

Acreage and location.

Data Collection Method: Insect and diseases infestations by airplane. Mapping of each wildfire location and acreage by field crews.
Data Collection Frequency: Annual aerial I&D detection surveys. Annual mapping of each wildfire location and acreage.
Precision and Reliability: Class A: GPS mapping of each wildfire location and acreage. Class B: Aerial I&D detection surveys with outbreaks hand-drawn on maps.
Analysis Method: Total forest acreage by disturbance agent derived from a GIS query on all NFS lands. Identify a trend over time to determine if forest management activities are reducing incidents of natural disturbance. Determine disturbance probabilities as were used in Spectrum and VDDT modeling.
Benchmark Thresholds: No epidemic insect or disease outbreaks. No large scale wildfires in fuels created by insects and diseases..
Data Storage: GIS insect & disease and wildfire layers.
Responsibility: Forest Silviculturist (I&D), Fire Ecologist (wildfires), and GIS (updating of data layers).
Reporting (Evaluation) Frequency: Insect & disease outbreaks: Annually Wildfires: Annually. Identifying disturbance trends and model probabilities: 10th year
Estimated Cost per Unit: Aerial detection of I&D cost covered by North Central Research Station. Wildfire mapping covered by individual wildfire incident. $500 for GIS updates by forest GIS personnel for I&D data. $150 for documentation for monitoring report.
Cooperators: North Central Research Station
References

Social & Economic Stability

Monitoring and Evaluation Question:

To what extent do output levels, location of timber harvest and mix of saw timber & pulpwood compare to those levels?

Descriptions:

Amount of timber harvest and mix of products is directly related to the outcomes derived as a result of moving towards the management area vegetative desired condition, as well as the amount of suited acres available. Timber harvest is an important component of social sustainability and is a scheduled management practice. Monitoring will validate if the forest is meeting modeled outputs resulting from achieving desired vegetative conditions.

Monitoring Indicator:

Timber ASQ and product mix from suited lands.

Resource Keywords:

Timber outputs, Pulpwood, Sawtimber, Timber harvest

Reference and Driver:

LRMP, p. 4-4, Chapter IV, Table 4-4. Monitoring Items.

A quantitative estimate of performance comparing outputs and services with those projected by the Forest Plan. Forest Plan Appendix A

Rationale and Explanation:

Vegetation management on suited lands helps the forest meet biological diversity and species viability, improves forest health, enhances ecosystem restoration, and is an important component to ecological and social sustainability.

Sampling Variables or Parameters:
Timber targets.

Authority:
Required by the LRMP.

Sampling Protocol (method / design):
No sampling is required. TRACS query request at end of FY after data base update.

Sampling Unit of Measure:
MBF and CCF of sawtimber and pulpwood.

Data Collection Method:
FACTS and TRACS data bases updated when timber sales are awarded and harvested.

Data Collection Frequency: Annually.
Precision and Reliability: Class A: Timber sales sold volume derived from cruise data; Timber sale harvest data from units harvested (usually cruised data).
Analysis Method: Comparison of annual awarded and harvested data compared to Forest Plan ASQ and modeled product mix estimates documented in the EIS.
Benchmark Thresholds: Forest Plan ASQ (108.5 mmbf). Closer the forest actual harvest and award volumes targets are to modeled ASQ, the closer the forest is in achieving desired conditions.
Data Storage: FACTS, TRACS
Responsibility: Forest Timber Program Leader
Reporting (Evaluation) Frequency: Annually
Estimated Cost per Unit: $300 for data base queries and documentation. $500 to update data bases.
Cooperators: None
References None

Soil Productivity

Monitoring and Evaluation Question:

Are the effects of Forest management, including prescriptions, resulting in significant changes to the productivity of the land?

Descriptions:

Tracking of Forest soil conditions to ensure soil productivity is maintained or improved. Monitoring will allow assessment of the effectiveness of implementing standards and guidelines aimed at protection of soil productivity.

Monitoring Indicator:

Percentage of harvest treatment areas with soils that have been detrimentally impacted per the R9 Soil Quality Standards. This includes a combination of compaction, displacement, rutting/puddling, severely burned, eroded, lack of ground cover, or subject to mass movement. These effects on soil lower site productivity. The percent of the area detrimentally impacted will be compared to R9 threshold standards.

Resource Keywords:

Soil, Soil Productivity, Compaction, Rutting, Puddling, Erosion, Displacement, Duff, Loss of Organic Matter

Reference and Driver:

2500 Watershed Management, Soil Resources Goals 2; Documentation of the measured prescriptions and effects, including significant changes in land productivity.

LRMP, p. 4-5, Chapter IV, Table 4-3. Monitoring Items.

Rationale and Explanation:

Soil productivity contributes to ecological sustainability of the Forest and is essential to meeting vegetative desired conditions.

Sampling Variables or Parameters:

Soil density, rutting, and puddling are used to measure compaction and loss of soil structure. Soil displacement is used to measure erosion, and duff layer lost on ELT 10 soils measure changes in soil productivity.

Authority:

Required by the LRMP and National Forest Management Act of 1976.

Sampling Protocol (method / design):

All harvested stands within a calendar year will be selected from CDS/FSVeg/FACTS. The treated stands will be joined to the Stands layer in ArcMap, and a minimum of 15% of the treated stands will be visited for soil monitoring.

The sampling design methodology to assess soil disturbance were modified from those described by Howes, Hazard and Giest (1983). This method involves randomly locating line transects in an activity area and evaluating soil conditions along a continuous 100 foot long transect. It is planned to randomly sample at a density of at least one transect

per five acres. Along each transect, data will be collected on compaction, puddling, rutting depth, duff layer removed, and soil displacement.

Sampling Unit of Measure:

Compaction: Soil density calculated by weight per cubic centimeter. This value will be compared to standard weight for same soil type; and root limiting density established by soil texture.

Rutting/Puddling: Percent of plot area with ruts greater than 6 inches deep (per R9 SQS).

Duff Layer: Percent of transect with duff removed (mechanical or burned).

Soil Displacement: Percent of soil in plot moved off plot.

Data Collection Method:

Data is to be collected the same season (if practical) after harvest but no later then the next field season. Areas harvested during winter will have soil data collected after the winter but before the next winter.

Data Collection Frequency:

Annually.

Precision and Reliability:

Class A: Sampling by random plots.

Analysis Method:

Percentage of transect with soils considered compacted, rutted, or displaced will be compared to R9 Soil standards.

Benchmark Thresholds:

No more then 15% of a harvest treatment area will have soil compacted, rutted, or displaced.

Data Storage:

Data stored in Excel, Access or other database format.

Responsibility:

Forest Soil Scientist/Forest Landscape Ecologist

Reporting (Evaluation) Frequency:

Annually.

Estimated Cost per Unit:

$100 to install each transect. Data analysis and results write up at $1000.

Cooperators:

Data shared with NRCS

References:

Howes, S.; Hazard, J.; and Giest, JM. 1983. Guidelines for sampling some physical conditions of surface soils. Portland, Or: US Department of Agriculture, Forest Service, Pacific Northwest Region; R6-RWM-146-1983 34 pages.

USDA Forest Service, Eastern Region. 2005. FSH 2509.18 Soil Management, Chapter 2 Soil Quality Monitoring. R9RO 2509.18-2005-1. February 23, 2005.

Transportation –Road Densities

Monitoring and Evaluation Question:

To what extent is the Forest meeting its transportation system objectives? (open motorized road & trail densities)

Descriptions:

Tracking of Forest progress toward achieving Management Area trail and road densities. Monitoring will assess effectiveness of road closures, decommissioning, and obliteration of moving the Forest road densities to desired conditions.

Monitoring Indicator:

Motorized Trail and Road densities.

Resource Keywords:

Transportation, Trail and Road Densities, Construction, Decommission

Reference and Driver:

LRMP, p. 4-6, Chapter IV, Table 4-3. Monitoring Items.

7700 Transportation System, Trail and Road Density, Guideline 1. To construct and/or decommission roads to bring all management area road densities in line with Forest Plan guidelines.

Rationale and Explanation:

The Forest provides a system of roads to accomplish required management activities and meet the needs of a variety of uses. The transportation system is designed to consider the environmental, social and health concerns of the public. Roads will be maintained at a level commensurate with the use planned.

Sampling Variables or Parameters:

Trail and Road densities per square mile of NF lands.

Authority:

Required by the LRMP.

Sampling Protocol (method / design):

No sampling is required.

Sampling Unit of Measure:

None required.

Data Collection Method:

Updating of Forest wide GIS transportation layer and INFRA data bases is required. GIS personnel and Forest Transportation Engineer are the responsible individuals.

Data Collection Frequency:

Updating of GIS and INFRA data bases when road management NEPA decisions are signed.

Precision and Reliability: Class A and Class B. Updating of GIS and INFRA data bases during project planning and mid-scale analysis can be both Class A & B. Ocular estimates ("heads up" digitizing) to fill in data gaps or update old information for road management decision is Class B. Updates by GPS collected road data for project analysis and decisions are Class A.
Analysis Method: In GIS, for each individual management area, intersect Management Area layer with the Trail and Road layers to determine total trail and road miles within each MA. Divide these totals by the individual Management Area square miles to find the densities per square mile. Motorized trail densities identified in Table 7700-1 will not exceed these averages across the management areas. Motorized road densities identified in Table 7700-1 shall be met for each individual management area.
Benchmark Thresholds: Achieve Trail and Road Densities Guideline (Table 7700-1. Maximum Trail and Road Densities) for each Management Area by 2012.
Data Storage: GIS transportation layer and INFRA data bases.
Responsibility: Forest Transportation Engineer
Reporting (Evaluation) Frequency: 1st, 5th and 10th years.
Estimated Cost per Unit: GIS and INFRA data base updates accomplished for project and mid-scale analysis. $100 to develop and run GIS query by Management Area.
Cooperators: County Road Commissioners
References None

Timber Regeneration

Monitoring and Evaluation Question:

Are harvested lands adequately restocked after 5 years?

Descriptions:

Suited timberland is the landbase where scheduled timber harvesting (vegetation management) may occur. Suitability requires that the lands can be adequately regenerated within 5 years. Monitoring will allow assessment of the effectiveness that lands selected as part of the suited landbase can be regenerated.

Monitoring Indicator:

Regeneration certified after 5 years from timber harvest.

Resource Keywords:

Timber suitability, Timber harvest, Regeneration

Reference and Driver:

Forest Plan Appendix A – Suitability.

Lands are adequately restocked as specified in the Forest Plan.

Rationale and Explanation:

Vegetation management on suited lands helps the forest meet biological diversity and species viability, improve forest health, enhances ecosystem restoration, and is an important component to ecological and social sustainability. A required element of timber suitability is capability of regeneration within 5 years following a regeneration harvest.

Sampling Variables or Parameters:

Presence of all acceptable tree seedlings with species identified.

Authority:

Required by the LRMP and NFMA.

Sampling Protocol (method / design):

Each regeneration harvest unit has randomly selected plots installed covering all aspects of the unit. Plots will cover 0.5 percent of the unit area.

Sampling Unit of Measure:

1/100th acre plot size.

Data Collection Method:

Plots installed by field crew personnel.

Data Collection Frequency:

First and third year following planting; first and third year at minimum plus fifth year if needed following natural regeneration activities or artificial seeding.

Precision and Reliability:

Class A: Random plots covering entire unit.
Class B: Walk thru ocular estimates of stocking levels covering entire unit.

Analysis Method: Estimates of unit stocking levels from plots.
Benchmark Thresholds: Regeneration harvest units are considered stocked if at end of the 5th year following timber harvest, at least 90 percent of the unit is adequately stocked with seedlings of desired tree species.
Data Storage: FSVeg and FACTS databases.
Responsibility: Forest Silviculturist
Reporting (Evaluation) Frequency: Annually.
Estimated Cost per Unit: $10.50 per acre of regeneration unit. $300 to analyze all units and prepare documentation for monitor report.
Cooperators: None
References National Forest Management Act

Non-Native Invasive Species

Monitoring and Evaluation Question:

How effective is the Forest at treating and controlling the spread of NNIS?

Descriptions:

Non-native invasive species (NNIS) include aquatic and terrestrial animals and plants that have the potential to cause a variety of negative impacts to terrestrial and aquatic ecosystems on the Forest. Forest activities that expose bare soil provide the greatest opportunities for terrestrial NNIS establishment.

Monitoring Indicator:

Terrestrial: Presence of NNIS on disturbed soils from road construction, reconstruction, closing and obliteration, recreation trails, and timber harvest activities (skid trails, landings, etc).

Aquatic: Presence of NNIS in lakes and streams.

Resource Keywords:

Non-Native Noxious Invasive Species, Terrestrial, Aquatic, Disturbed Sites, Soils

Reference and Driver:

2400 Vegetation Management Desired Condition and Goals 1- 3; 2500 Watershed Management, Desired Condition; 3400 Forest Pest Management, Goals 1, 3, 4; Objectives 1 and 2; Guidelines 1, 2, 4;

LRMP, p. 4-6, Chapter IV, Table 4-3. Monitoring Items

Rationale and Explanation:

The vast majority of terrestrial non-native invasive plant populations on the Hiawatha occur on roadsides, in skid trails, at landings, on temporary roads and other disturbed areas. Other areas where invasive species occur are gravel pits, power line corridors, parking areas, campsites and trails. Monitoring provides feedback to management of the Forest's ability to effectively control the spread of and eradicate populations of NNIS.

Aquatic NNIS primarily occurs in a few lakes with motor boat access and in wetlands in close proximity to roads. Some invasives spread through a watercourse from motorized areas to non-motorized.

Sampling Variables or Parameters:

Terrestrial: Ground disturbed sites with exposed mineral soils.

Aquatic: Lakes with motorized setting, downstream non-motorized areas, and wetlands associated with these areas.

Authority:

Required by the LRMP.

Sampling Protocol (method / design):

Terrestrial: Determine if populations of NNIS have become established by systematic

sample surveying previously disturbed sites and during routine visits to other project areas. Random samples are not adequate because effectiveness of control is highest when newly established populations are treated before seed production and dispersal occurs. Aquatic: Visits to motorized lakes and associated wetlands during the course of the growing season to inspect for presence of NNIS. Monitoring efforts for specific species will be required at specific times when identification is possible, for example while they are flowering but before it sets seed.
Sampling Unit of Measure: Terrestrial: Sites with exposed mineral soils such as roadsides, skid trails, timber sale landings and temporary roads, gravel pits, power line corridors, parking areas, campsites, and trails near or adjacent to known NNI populations. Aquatic: Motorized Lakes and wetlands downstream from known NNIS populations.
Data Collection Method: Field visits to ground disturbed sites, motorized lakes and wetlands at risk.
Data Collection Frequency: Updating of GIS NNIS layer and data bases of existing and new populations of NNIS.
Precision and Reliability: Class A: Sites with known NNIS populations in GIS. Class B:
Analysis Method: Updating of GIS NNIS layer and data bases.
Benchmark Thresholds: Stopping the spread of NNIS.
Data Storage: GIS NNIS layer and Terra? data bases.
Responsibility: Terrestrial: Forest Botanist Aquatic: Watershed Program Manager/Landscape Ecologist or Forest NNIS coordinator.
Reporting (Evaluation) Frequency: Annually, 5th & 10th years.
Estimated Cost per Unit: Terrestrial: $500 / sale area to $50 / disturbed site. Aquatic: $250 field visit for each motorized lake. $200 field visit for each wetland area at risk. $1,250 to update GIS NNIS layer & data base. $600 for monitoring report documentation.

Cooperators: NA
References Eastern Region NNIS Strategy; HNF NNIS Strategy.

Heritage Resources

Monitoring and Evaluation Question:

How are Heritage properties being protected from damage or disturbance:

Descriptions:

Tracking the protection of heritage sites from earth disturbing activities and recreation use.

Monitoring Indicator:

Number and type of heritage resource sites at risk from earth disturbing activities and recreation use.

Resource Keywords:

Native American Tribes, Heritage sites, Historic, Pre-historic,

Reference and Driver:

2300 – Recreation Management, Heritage Resources, Goal 1, Objective 1 & 4, Guidelines 1 & 2. LRMP, p. 4-7, Chapter IV, Table 4-3. Monitoring Items.

Rationale and Explanation:

Heritage sites consist of the physical evidence for human occupation, activities, or events and the place or places where the evidence survives in a context that allows for research, interpretation, preservation and/or use as an educational tool for connecting people with cultural and natural history. Heritage resources also provide important scientific information on how human activity has affected the environment and helps land mangers formulate and explain current natural resource management practices.

Sampling Variables or Parameters:

Site disturbance.

Authority:

Required by the LRMP and laws (National Historic Preservation Act, American Indian Religious Freedom Act, Archaeological Resources Protection Act, Native American Graves Protection and repatriation Act, Government-to-Government Relations with Native Americana Tribal Government – 1994), and regulations: 36 CFR 79; 36 CFR 800; 43 CFR 3; 43 CFR 7; and 43 CFR 10.

Sampling Protocol (method / design):

Field visits to 2 percent per year of known heritage sites selected at random; and review of planned ground disturbing activities before the disturbance can begin .

Sampling Unit of Measure:

Sites damaged.

Data Collection Method:

Field visits visually inspecting if damage is occurring.

Data Collection Frequency: Annually.
Precision and Reliability: Class A. Field visits to known sites visually inspecting if any damage is occurring.
Analysis Method: Percent of sites found disturbed from total sampled and discovered from pre-disturbance surveys.
Benchmark Thresholds: No heritage sites disturbed or lost.
Data Storage: Heritage data base.
Responsibility: Forest Archaeologist
Reporting (Evaluation) Frequency: Annually.
Estimated Cost per Unit: $25 per site visit.
Cooperators: Native American Tribes
References: Washington Treaty of 1836, Memorandum of Understanding Regarding Tribal – USDA – Forest Service Relations on National Forest Lands Within the Territories Ceded in treaties of 1836, 1837, and 1842 (Voight MOU). 36 CFR 79; 36 CFR 800; 43 CFR 3; 43 CFR 7; 43 CFR 10.

MIS – Sharp-tailed grouse

Monitoring and Evaluation Question:

Are habitat trends of MIS (sharp-tailed grouse) consistent with Forest Plan expectations?

Descriptions:

Tracking of Forest vegetative conditions and sites identified important to sharp-tailed grouse will help to ensure desired levels of habitat are maintained. Monitoring will assess effectiveness of implementing the forest plan vegetative composition objectives for sharp-tailed grouse and other species that require similar habitat and validate modeling predicted in the EIS.

Monitoring Indicator:

Amount of vegetative conditions (acres) identified for sharp-tailed grouse. Dancing male grouse and total birds will be counted at leks.

Resource Keywords:

MIS, Management Indicator Species, sharp-tailed grouse, open-land, habitat, lek

Reference and Driver:

2600 Wildlife, Fish and Sensitive Plant Habitat Management, Desired Condition, Goals 1, 2, & 4, Vegetation Management Standards 1, Sharp-tailed grouse Objective 1. Management indicator species will be monitored and relationships to habitat changes determined.

LRMP, p. 4-5, Chapter IV, Table 4-3. Monitoring Items.

Rationale and Explanation:

MIS are monitored during Forest Plan implementation to assess the effects of management activities on their habitat, as well as the habitat of other species with similar needs that they represent. MIS habitat monitoring will provide the basis for addressing requirements to maintain viability in the planning area of native and desired non-native species. For all MIS, it is assumed that there is a direct correlation between habitat availability and species populations.

The sharp-tailed grouse was selected because it was the only species meeting selection criteria that is associated with open land habitat.

Sampling Variables or Parameters:

No sampling of forest vegetation required.

Need to determine forest wide acreage of open lands vegetation conditions for each ELT (10/20, 30, 40/50/90, 60, 70A, 70B, 80A, 80B). Use wildlife spreadsheets developed for revision EIS effects analysis.

Census of individuals at leks.

Authority:

Required by the LRMP.

Sampling Protocol (method / design):
No vegetation sampling is required.
For observations at leks, the following would apply, at minimum every two years:
Attempt to survey each Lek at least twice during the season, at least 1 week apart. Begin surveys as soon as the birds become active on the dancing ground. Usually about April 1 to May 15. The best counts are obtained shortly after dawn, but birds may still be on the dancing grounds until about 10:00 a.m. Avoid doing the survey during periods of heavy rain or high winds. The best technique is to observe the dancing ground from a distance with binoculars and attempt to count all dancing males. Only the males display but females may be present. When confident that the males have been counted, approach the dancing ground and count all flushed birds.

Sampling Unit of Measure:
Post treatment vegetation condition parameters to allow seral and size determination are forest cover type and stand age.
Number of males and total number of birds will be documented.

Data Collection Method:
Updating of Forest wide GIS stand layer and existing vegetation data bases (FSVeg) is required for all signed NEPA vegetation management decisions.

Data Collection Frequency:
5th and 10th year for forest vegetation trends.
Updating of GIS and data bases when vegetation management NEPA decisions are signed (see forest vegetation monitoring question).
Number of males and total number of birds will be documented annually.
Lek counts will be conducted at least once every two years.

Precision and Reliability:
Class A: Updates by new stand exams collected for project analysis and decisions. Number of males and total number of birds observed.
Class B: Updating of GIS and data bases when vegetation management NEPA decisions are signed are professional opinion expected results. Ocular estimates (walk thru survey) to fill in data gaps or update old information for vegetation management decision is also acceptable.

Analysis Method:
ELT seral and size classes acreage are determined via a GIS query of existing vegetation composition on all lands (suited and unsuited). Data is pasted into sharp-tailed grouse habitat spreadsheets. Use same spread sheet as an analysis tool (available in forest plan analysis files).
Total dancing male grouse and total flushed at leks are summarized for the HNF.

Benchmark Thresholds:
Compare updates to EIS Sharp-tailed grouse write-up to assess if expected results are achieved or not.
Compare lek counts to those conducted in previous years.

Data Storage: Internal databases and spreadsheets on the J:\ and G:\ drives.
Responsibility: Forest Wildlife Biologist
Reporting (Evaluation) Frequency: 5th and 10th year for forest vegetation (habitat) trends. Lek numbers reported when counts are conducted (at least every two years).
Estimated Cost per Unit: $100 to run GIS queries and $300 results write up. Variable costs for lek counts depending upon level of participation.
Cooperators: MDNR
References: None