



United States Department of the Interior

COPY

FISH AND WILDLIFE SERVICE

East Lansing Field Office (ES)

2651 Coolidge Road, Suite 101

East Lansing, Michigan 48823-6316

IN REPLY REFER TO:

March 2, 2006

Ms. Leanne Marten, Forest Supervisor
Huron-Manistee National Forests
1755 South Mitchell Street
Cadillac, Michigan 49601

Re: Formal Section 7 Consultation for the Programmatic Biological Opinion for the Revised Huron-Manistee National Forests Land and Resource Management Plan.

Dear Ms. Marten:

This document transmits the U.S. Fish and Wildlife Service's biological opinion for the revised Huron-Manistee National Forests (Forest) Land and Resource Management Plan, and its effects on the Karner blue butterfly (*Lycaeides Melissa samuelis*), Indiana bat (*Myotis sodalis*), bald eagle (*Haliaeetus leucocephalus*), Kirtland's warbler (*Dendroica kirtlandii*), Pitcher's thistle (*Cirsium pitcheri*), Great Lakes piping plover (*Charadrius melodus*), and piping plover designated critical habitat in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C., 1531 et seq.). Your request for formal consultation was received on August 23, 2005.

This biological opinion is based on information provided in the biological assessment, draft Land and Resource Management Plan, draft Environmental Impact Statement, a variety of agency reports, published literature, and information obtained from meetings and discussions with the Forest. A complete administrative record of this consultation is on file at this office.

We greatly appreciate the assistance and cooperation of your staff throughout this consultation process. Please contact me at 517-351-8470 with any questions or comments.

Sincerely,

Craig A. Czarnecki
Field Supervisor

cc: ARD-ES

Biological Opinion
for the
Huron-Manistee National Forests
Land and Resource Management Plan

March 2006

Prepared by:
U.S. Fish and Wildlife Service
East Lansing Field Office
2651 Coolidge Road, Suite 101
East Lansing, Michigan 48823

CONSULTATION HISTORY

- *August 23, 2005:* The Service received the Huron-Manistee National Forests' (Forest) August 19, 2005 request for formal consultation on the Revised Land and Resource Management Plan (proposed Plan). The request included a BA that described the proposed Plan and made determinations of "may effect, likely to adversely affect" for the Pitcher's thistle, Kirtland's warbler, bald eagle, piping plover, Karner blue butterfly, and Indiana bat. The Forest made a determination of "may effect, not likely to adversely affect" for designated piping plover critical habitat.
- *September 16, 2005:* The Service responded to the Forest's request for formal consultation, indicating that the information received in the BA constituted a complete initiation package.
- *September – December 2005:* Jessica Hogrefe (USFWS) worked with Forest biologists via email and telephone to discuss the proposed Plan and effects to listed species.
- *December 20, 2005:* The Service transmitted a Draft Programmatic Biological Opinion to the Forest for review.
- *January 2006:* The Forest transmitted several sets of comments to the Service on the Draft Programmatic Biological Opinion. Jessica Hogrefe discussed these comments with the Forest biologists and incorporated changes, where appropriate.
- *February 6, 2006:* The Service transmitted a Draft Final Programmatic Biological Opinion to the Forest for review.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Proposed Action

The U.S. Forest Service proposes to revise the 1986 Forest Land and Resource Management Plan for the Huron-Manistee National Forests (HMNF, Forest, Forest Service). Under the National Forest Management Act, Forest Plans must be developed to guide all long-term natural resource management activities on National Forest System lands. They describe desired resource conditions, resource management practices, levels of resource production and management, the availability of suitable land for resource management, and monitoring and evaluation requirements for effective implementation. Forest Plans provide management direction for 10 – 15 years to ensure that ecosystems are capable of providing sustainable benefits to the public.

The goals of the Revised Forest Plan (proposed Plan) for the Huron-Manistee National Forests (proposed Plan) are protection and enhancement of resources, sustained vegetation management, and enhancement of social and economic benefits. The Forest Plan identifies desired conditions related to these goals that are broad statements specifying what the Forest Service will strive to achieve. Specific, measurable objectives are stepped down from these desired conditions. Finally, standards and guidelines provide the specific technical direction for managing resources. Standards are required limits to activities, while guidelines are preferred limits. Site-specific projects implement the Forest Plans and are developed to bring the Forest closer to the goals and desired conditions identified. However, the Forest Plan does not propose any site-specific projects; it is programmatic in scope and does not contain decisions to implement specific actions or projects. Therefore, this consultation is limited to the consideration of effects of the broader programmatic strategy for managing Forest resources. The U.S. Fish and Wildlife Service (USFWS, Service) expects future consultation on actions and programs that are proposed, analyzed, and implemented under this Forest Plan.

The Forest determined that the proposed action may affect, and is *likely to adversely affect* the Pitcher's thistle, piping plover, bald eagle, Kirtland's warbler, and Karner blue butterfly. The Forest also determined that the proposed action is *not likely to adversely affect* piping plover critical habitat. We concur with these determinations and the following biological opinion addresses whether the proposed action of implementing the proposed Plan, including any interrelated or interdependent actions, is likely or not likely to jeopardize the continued existence of these species.

Programmatic Consultation Approach

This programmatic biological opinion establishes a two-level consultation process for activities completed under the Forest Plan (Table 1). Evaluation of the Forest Plan at the plan level represents the Level 1 consultation and all subsequent project-specific evaluations for future actions completed under the Forest Plan are the Level 2 consultations. Under this approach, the Level 1 programmatic opinion establishes guidelines and conditions that each individual future project must adhere to and operate within to remain consistent with the scope of the Level 1

opinion; these future projects will be subject to Level 2 consultations. The Level 1 programmatic opinion and incidental take statement (ITS) will estimate the level of incidental take that is anticipated to occur from future Level 2 projects. Due to the temporal and spatial uncertainty that exists at the Forest Plan level regarding this anticipated incidental take, however, incidental take will be exempted in the Level 2 biological opinions for site-specific actions as they are proposed, consulted on, and appended to the programmatic opinion (specific details of this process are described below). This will help ensure that the Forest adheres to the reasonable and prudent measures needed to appropriately minimize the impacts of the incidental take that will result from the Level 2 action under review, while not being inappropriately burdened by those reasonable and prudent measures that are pertinent to other Level 2 actions.

Table 1. Outline of a programmatic consultation approach.

Level 1 Consultation and Biological Opinion	Establishes guidelines and conditions applicable to all future projects
	ITS estimates incidental take that is anticipated to occur from all future projects, but does not provide exemption
Level 2 Consultation and Biological Opinion	Establishes project-specific guidelines and conditions
	ITS estimates and exempts incidental take that is expected for each project, including appropriate reasonable and prudent measures and terms and conditions

Under this programmatic approach, the Forest Service must continue to review all future individual projects to determine if they may affect a listed species or designated critical habitat. Future projects that may affect listed resources are subject to Level 2 consultation; written notification to the Service, including a biological assessment as necessary, of such projects is required. Projects that may affect, but are not likely to adversely affect listed species or designated critical habitat will require written concurrence from the Service through informal Level 2 consultation. In most cases the response time for these concurrences should be significantly abbreviated. Projects that are likely to adversely affect listed species or designated critical habitat will be individually reviewed to determine: 1) whether they were contemplated in the Level 1 programmatic opinion and 2) if they are consistent with the guidelines established in the Level 1 programmatic opinion and whether the reasonable and prudent measures and terms and conditions provided in the incidental take statement are applicable. This will ensure that the effects of any incidental take resulting from individual projects is minimized. In response, we will produce a Level 2 opinion that will be appended to the original programmatic opinion. Level 2 opinions will update the status of the species and environmental baseline project-by-project, as appropriate. The Level 2 opinions will provide exemption for some incidental take in accordance with the reasonable and prudent measures and terms and conditions provided in the Level 1 programmatic incidental take statement, plus any additional project-specific measures required to minimize effect of the incidental take, as necessary. The original programmatic opinion taken together with all project documentation contained in the Level 2 opinion will make up the complete biological opinion for each Level 2 project. In most cases implementing a programmatic consultation approach should significantly reduce the time required to complete formal consultation (e.g., 30 days instead of 90 days).

Future projects that are likely to adversely affect listed species or critical habitat, and do not adhere to the guidelines and conditions evaluated during the programmatic consultation, or any future projects that are considered to be outside the scope of the proposed action or Forest Plan, may require separate formal consultations.

Action Area

The action area includes all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area is defined by measurable or detectable changes in land, air and water or to other measurable factors that will result from the proposed action. The action area is not limited to the “footprint” of the action, but rather encompasses the biotic, chemical, and physical impacts to the environment resulting directly or indirectly from the action.

In general, the action area for the purposes of this analysis is all lands, under any ownership, within the proclamation boundary of the Forest. During their analysis, the Forest did not identify any direct or indirect effects that moved outside of this area.

The proclamation boundary of the HMNF includes 2,025,769 ac (819,817 ha) located in two forest units, one in eastern and one in western Lower Michigan (Figure. 1). The Huron National Forest (Huron NF), located in Alcona, Crawford, Iosco, Ogemaw, and Oscoda counties in the northeastern portion of the Lower Peninsula of Michigan, is divided into three Ranger Districts: Tawas, Harrisville, and Mio. These districts are managed out of two ranger stations, one at Mio and the other at Oscoda, Michigan. The Huron NF boundary encompasses 694,098 ac (280,898 ha), 433,915 ac (175,603 ha; 63 percent) of which are National Forest System lands managed by the Forest Service (USFS 1999). The Manistee National Forest (Manistee NF), located in Lake, Manistee, Mason, Mecosta, Montcalm, Muskegon, Oceana, Newaygo, and Wexford counties in the northwestern one-quarter of Michigan’s Lower Peninsula, is divided into four Ranger Districts: Baldwin, Cadillac, Manistee, and White Cloud. These districts are managed out of two ranger stations, one at Manistee and one at Baldwin, Michigan. The Manistee NF boundary encompasses 1,331,671 ac (538,920 ha), 534,916 ac (216,478 ha; 40 percent) of which are National Forest System lands managed by the Forest Service (USDAFS 1999).

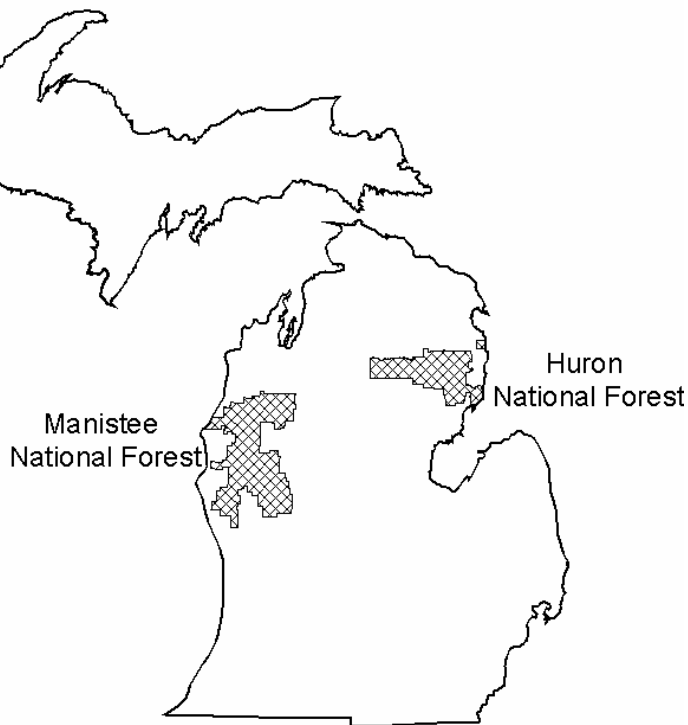


Figure 1. Map of the Action Area

Project Description

The Revised Forest Plan emphasizes providing sustainable amounts of timber, maintaining or enhancing biodiversity, contributing to economic and social needs of the community, and managing in an environmentally sound manner to produce goods and services that provide for long-term public benefits. Forest Plan activities assessed in this biological opinion are limited to those that are 1) directed or allowed and 2) proposed or probable. In many areas of the Forests, these activities include timber harvest, timber stand improvements, wildlife habitat management, road and trail construction and maintenance, construction and maintenance of dispersed recreation facilities and water accesses, hazardous fuels reduction, riparian and stream restoration, and habitat improvement. In other areas of the Forests, natural ecological processes will predominate.

The Revised Forest Plan includes many objectives, standards, and guidelines for the protection of listed species and enhancement of their habitats, which are described in the BA (USFS 2005a). The following sections summarize the types of management that occur on the Forest that are relevant to the analysis of potential effects on listed resources. Forest management is discussed by 1) Management Activities, 2) Management Areas, 3) Forest-wide Goals, Objectives, Standards, and Guidelines, and 4) Monitoring and Evaluation.

The information in the following four sections was taken from the Forest Plan Revision Draft Environmental Impact Statement (USFS 2005b) and proposed Plan (USFS 2005a).

In each of the following four sections, we summarize portions of the proposed Plan. To minimize repetition of the proposed Plan in this document, however, only those aspects of the proposed Plan that are most pertinent to listed species on the Forest are addressed. In addition, as necessary, further information on specific actions from the proposed Plan will be provided in the individual species effects analyses. However, we consider the proposed Plan in its entirety when assessing impacts to listed species.

1. Management Activities

This section summarizes those forest management activities that are most pertinent to listed species on the Forest. Within each management activity, we selectively focus on those aspects that are most likely to impact listed species.

2400 TIMBER MANAGEMENT

Timber harvest, for the primary purposes of providing commercial timber products and for managing wildlife habitat, is one of the primary management activities that alters forest habitat (Table 2). Currently, approximately 40% of the Forest's land area is considered suitable for timber management (USFS 2005a). The remainder of land area is either not suited due to inadequate information, physical constraints, other resource issues, or legal reservation (i.e., wilderness). The harvest method is based upon the vegetative type that is to be regenerated and how that regeneration is to be accomplished either naturally or artificially.

Timber management activities can be broken down into the following components:

- Road construction: access roads to harvest stands, most of which are small and temporary.
- Skid roads and log landings: these are the routes and storage areas for harvested timber and equipment
- Even-aged or uneven-aged management: see below
- Barrens creation: barrens habitat created and maintained through timber harvest and prescribed burning
- Salvage harvest: see below
- Hazard tree removal: removal specific trees that pose a threat to human safety, typically around trails, roads, and recreation areas
- Firewood cutting: permitted removal of standing and down dead trees in designated areas

Even-aged management, which maintains stands of similar age class or size trees, is the primary silvicultural method used on the Forest. There are three primary methods of even-aged management; clearcutting, shelterwood, and thinning. Clearcutting maximizes harvest by removing all trees in a stand with one cut. Clearcutting is used where regeneration of early successional species is a priority and may favor species of wildlife that use open and young-growth habitat. Shelterwood cuts remove all trees in a stand in two or three cuts. Shelterwood cuts are designed to improve the vigor and seed production of remaining trees while preparing the site for new seedlings and are best used where seeds and seedlings are species tolerant of a partial overstory. Shelterwood cuts remove mature trees and favor species of wildlife that use open and young-growth habitat. Thinning cuts remove 30 to 40 percent of the of the basal area

in a stand and are designed to improve stand growth, stand yield, and improve some types of wildlife habitat. Thinning is employed primarily in red pine stands on the Forest.

Uneven-aged methods are used in northern hardwood stand types on the Forest. A stand is considered uneven-aged if three or more 20-year classes are represented within the stand. With an uneven-aged system, a portion of each age class in each stand must be harvested on a routine cutting cycle (i.e., 10 to 20 years). Uneven-aged methods employ either the periodic removal of individual trees (single-tree selection) and or small clearcuts of trees (group selection), leaving mature tree classes in the stand at all times. The individual-tree selection method will be the predominant uneven-aged harvest method used on these Forests.

Table 2. Acres of proposed and Probable Harvest Silvicultural Methods in the First and Second Decades From Lands Suitable for Timber Production.

Vegetation Class	Thinning		Clearcut		Shelterwood		Selection	
	Decade 1	Decade 2	Decade 1	Decade 2	Decade 1	Decade 2	Decade 1	Decade 2
Aspen/Birch			24,100	28,000				
Short-lived Conifer			14,166	17,923				
Long-lived Conifer	35,432	54,512	1,634	1,096				
Low-site Oak			5,244	77				
High-site Oak	24,025	1,146			8,261	22,879		
Northern Hardwood								16,299
Total Decade 1	59,497		45,144		8,261		0	
Total Decade 2		55,658		47,096		22,879		16,299

Other types of timber harvest that occur on the Forest are firewood cutting and salvage harvests which are used when diseases or other natural events, such as storms, produce dead or dying trees in excess of what is normally considered necessary for wildlife or other forest management goals.

The Forest also manages timber on some lands that are not suitable for standard timber production (Table 3). The primary focus of this management is the creation and maintenance of barrens and openings. The Forest creates barrens habitat using timber harvest and prescribed burning.

Table 3. Acres of Proposed and Probable Silvicultural Methods in the First and Second Decades From Lands Not Suitable for Timber Production.

Vegetation Class	Create Barrens		Create Openings		OG to Barrens		OG Restoration	
	Decade 1	Decade 2	Decade 1	Decade 2	Decade 1	Decade 2	Decade 1	Decade 2
Aspen/Birch								
Short-lived Conifer	130	4,248	1,990			603		
Long-lived Conifer	4,250	5,347	5,300	1		657		6,347
Low-site Oak	794	4,823	800			1,178		
High-site Oak	2,551	2,548						
Northern Hardwood								
Total Decade 1	7,725		8,090		0		0	
Total Decade 2		16,966		1		2,438		6,347

2200 RANGE MANAGEMENT

The Forests' DEIS (2005b) details range management on the Forest. Livestock grazing is permitted in allotted grasslands under authorized grazing permits maintaining habitat for the grassland bird species as well as other wildlife species. This program provides accessible water sources, fences, gates, holding areas, salt licks or other sites for grazing purposes. The locations, stocking rates, and movements of grazing herds will be managed to achieve grassland habitat management goals.

Currently, range opportunities exist in MAs 1.1, 2.1, 3.1, 4.1, 4.2, 4.3, 4.4, 8.1 (except RNAs), and 9.1 (USFS 2005b). These MAs represent approximately 741,000 acres (77 percent) of the Forests lands. However, livestock grazing only occurs on approximately 1,000 acres (less than 1 percent) of the Forests. This reflects the limited availability of lands on the Forests in a suitable open land condition with appropriate vegetation and structural conditions for range management (USFS 2005b).

There are currently four grazing allotments encompassing a total of 927 range-capable acres (375 ha) on the Forest. Three allotments are on the Manistee, and one is on the Huron. Current animal unit month capacity is approximately 1,000. On these allotments, grazing and hay cutting is permitted on existing forage areas. Livestock access to water sources on these allotments is controlled to limit impacts to aquatic habitats and water quality.

The proposed Plan reduces the potential range management opportunities on Forest lands because the acres within MAs where livestock grazing is permitted would be reduced by 3 percent to approximately 729,000 acres (74 percent of Forest lands). Additional or expanded grazing allotments beyond what currently exists is unlikely, however, because of the lack of available grasslands and the high cost of converting forested areas into productive range.

2300 RECREATION, WILDERNESS, AND RELATED RESOURCE MANAGEMENT

The Forest is a popular recreational destination for many Midwest residents. Over 60 million people are within a day's drive (USFS 2005b). In addition, much of the Forests' lands lies

adjacent to private and state lands and other recreational facilities which increases visitation in the area. The Forest provides opportunities for many different recreational activities such as hiking, camping, hunting, fishing, picnicking, canoeing, snowmobiling, off-road vehicle use, driving for pleasure, and gathering forest products. Proximity to population centers and high road densities increases the overall accessibility of the Forest. Recent studies indicate that the Forest receives more than three million visits annually or 64.2 Recreation Visitor Days.

The Forest Service uses a classification system called the Recreation Opportunity Spectrum to help describe differences in recreation settings, opportunities, and experiences and help guide management activities (Table 4). Recreation settings vary from primitive – where there is little evidence of other people, and more opportunities for self-reliance – to more developed rural areas which offer more facilities, better access, and opportunities to interact with other recreationists. The amount and location of each Recreation Opportunity Spectrum class provides an effective way to compare forest settings and recreation opportunities emphasized in each alternative.

Table 4. Acres by Recreation Opportunity Spectrum Class

Recreation Opportunity Spectrum Class	Acres
Primitive/wilderness - Unmodified natural or natural-appearing environment - Access and travel is nonmotorized on trails and cross-country - No facilities for user comfort	3,379
Semiprimitive nonmotorized - Natural-appearing environment - Access and travel is nonmotorized on trails, some primitive roads or cross-country - Rustic and rudimentary facilities primarily for site protection	62,301
Semiprimitive motorized - Predominantly natural-appearing environment - Low concentration of users, but often evidence of others on trails - Rustic and rudimentary facilities primarily for site protection	17,148
Roaded natural - Mostly natural-appearing environment as viewed from sensitive trails and roads - Access and travel is conventional motorized including sedans, trailers, RVs, and some motor homes - Rustic facilities providing some comfort for the user as well as site protection; moderate site modification for facilities	707,655
Rural - Natural environment is culturally modified yet attractive - Access and travel facilities are for individual intensified motorized use - Some facilities designed primarily for user comfort and convenience; moderate to heavy site modification	128,483
Variable/Special Designations	54,139
Total	973,105

The Forest emphasizes the recreational activities appropriate to a Roaded Natural setting. Currently, approximately 83.5 percent of the lands within Forests have features typical of the Roaded Natural class of the ROS. This would decrease under the proposed Plan to approximately 72.7%. Within these Roaded Natural areas, the Forest provides a variety of

developed recreation opportunities at campgrounds, water access sites, picnic sites, observations areas, visitor centers, and other facilities. The Nordhouse Dunes Wilderness Area is the only designated wilderness on the Forest and is managed primarily under the primitive ROS. Rural and urban areas contain some of the Forests' most developed recreational facilities.

Under the proposed plan, the overall acres of semiprimitive motorized and nonmotorized areas on the Forest will increase by approximately 8,448 acres. The semiprimitive nonmotorized and semiprimitive motorized inventoried areas offer a wide variety of trails and dispersed recreation opportunities such as hiking, camping, hunting, fishing, berry picking, trapping, bird watching, and many other remote recreation activities.

The Forest is home to more than 1,800 miles of rivers and 17,000 acres of lakes, providing an abundance of water-related recreational activities. Angling is a very popular recreational activity on the Forests. Many lakes and streams are within a short driving distance of large population centers and receive heavy use by anglers. Other less accessible lakes and streams are popular with campers and vacationers. Angling activities take place year-round on the Forests. Anadromous and native trout and salmon fisheries are available as well as many warm water fish species. Surveys completed in 2000 show that angling is the primary reason that 7.8 percent of the users visit the Forests. (Social and Economic Assessment for the Michigan National Forest, July 25, 2003).

Thousand of miles of trails exist on the Forest. Most trails are multiple use trails and provide a variety of recreation opportunities across the Forests, ranging from cross-country skiing and hiking to snowmobile and all-terrain vehicle riding. For nonmotorized purposes, the propose Plan makes few changes to the trail system. The Plan would, however, increase mountain biking opportunities on existing trails by permitting access to most nonmotorized trails.

For motorized use, guidelines in the propose Plan limit trail access within 1000 feet of water and from going through swamps. The propose Plan makes a significant change to snowmobile traffic on the Forest by opening unplowed roads to snowmobile use. This effectively increases the miles of snowmobile access on the Forest by approximately 3000 miles. However, because these roads will be ungroomed, the Forest expects that the majority of the snowmobile use will continue to occur on the designated trails.

The Plan proposes to close interior roads and trails in these areas would reduce the amount of dispersed recreational opportunities associated with motorized access on the Forests. Overall, the proposed Plan would result in more road closures, motorized trail relocations, decreased motorized access to recreational activities in some areas, increased semiprimitive recreational opportunities, and an improved semiprimitive experience.

2500 WATERSHED MANAGEMENT

The Forest has significant aquatic resources. There are approximately 1,500 lakes totaling about 17,000 surface acres within the proclamation boundary. There are four major river basins that have their headwaters within the Huron National Forest boundary, the Au Sable, Pine, Au Gres, and Tawas Rivers. There are eight major river basins within the Manistee National Forest, the

Manistee, Little Manistee, Pine, Big Sable, Pere Marquette, Pentwater, Muskegon, and White Rivers. These total approximately 3,364 miles of rivers and streams within the Forests proclamation boundary. Wetland areas on the Forest are most common in LTAs 4 and 5. Lowland conifers and swamp hardwoods are the predominant timber types. Other major classifications of wetlands include sedge meadow, marsh, open water, shrub swamp, wooded swamp and bog.

A few of these major river systems have multiple hydroelectric impoundments. There are ten major hydro-electric impoundments within the Forests' proclamation boundaries. They include are two on the Muskegon River, two on the Manistee River, and six on the Au Sable River. The impoundments range from 200 to 3,000 surface acres in size. These dams are under the authority of the Federal Energy Regulatory Commission and regulations of such dams on are beyond the jurisdictional control of the Forest Service. These hydroelectric facilities have had significant impacts on the riverine ecosystems. Dams on large rivers, along with smaller impoundments on private lands and numerous road stream crossings, have resulted in a fragmented aquatic habitat for fish species such as brook trout and mottled sculpin. The impoundments have also increased water temperatures, reduced sediment loads, and altered hydrology.

The proposed Plan includes goals and objectives to protect and improve aquatic habitat conditions and maintain high water quality. Water quality will be protected by employing Michigan Department of Natural Resources Best Management Practices (BMPs; MDNR 1994). These BMPs will be used to avoid an minimize effects from forest management actions, such as timber harvest, prescribed burning, and transportation management (i.e., stream crossings). As directed in the BMPs, the Forest will manage Streamside Management Zones with provisions for sediment filter strips, a base shade level, restriction on ground disturbance and protection of stream banks and streambeds.

Riparian areas consist of perennial streams, ponds, lakes, wetlands, and adjacent lands with soils, vegetation and landform indicative of high soil moisture or frequent flooding. Specific management and protection of sensitive riparian resources is addressed via protective standards and guidelines in the proposed Plan. The proposed Plan emphasizes old-growth management in the riparian corridor to protect riparian habitats. Riparian forests moving towards late seral stages ultimately leads to increased recruitment of large wood into the adjacent aquatic systems (both streams and lakes) thereby increasing hydraulic and aquatic habitat diversity. The proposed Plan also includes the placement of large woody debris in stream channels to facilitate the recovery of aquatic habitats. Additional restoration measures include streambank stabilization, gravel and cobble placement for spawning habitat, and fine sediment removal.

Conservation measures for sensitive species call for maintenance of approximately 2,500 acres of early successional habitat within riparian vegetation. Natural processes such as beaver, fire, windthrow and flooding create early successional vegetation within riparian zones and the Forest will allow these successional processes to continue without interference, provided other resource values are not being adversely impacted, even if they occur within designated old growth. Active management for early successional habitat within riparian corridors would only occur when natural disturbances processes were not providing adequate amounts of this habitat type.

Under the proposed Plan, wetlands would no longer be considered part of the definition of riparian. This removes some wetland protections because the Forest would not be required to 1) maintain a 100-foot riparian buffer around wetlands or 2) manage for late seral stages in wetlands. However, a new Standard and Guideline provided in the proposed Plan would require that activities in wetlands not change soils or hydrologic conditions. The proposed Plan emphasizes management of wetlands larger than 24 acres. All wetland areas would be surveyed for sensitive species prior to implementing any management activities, and all activities would follow the state's Best Management Practices during implementation.

2600 WILDLIFE, FISH AND SENSITIVE PLANT MANAGEMENT

The proposed Plan prescribes active management of forest vegetation types for a variety of wildlife, fish, and plant species on the Forest. The Forest focuses management on 1) Threatened, Endangered, and Sensitive Species, 2) Regional Forester Sensitive Species, and 3) Management Indicator Species. In addition, the Forest emphasizes protection and management of unique or rare habitat types.

In terrestrial habitat, these actions include requirements to maintain snags, den trees, mast trees and down wood; creation of wildlife openings; and operation restrictions in sensitive habitats. For aquatic habitats, these actions include maintenance of forest cover by watershed; sediment removal, erosion control (stream bank stabilization and improvement of transportation systems), introduction of large wood for structural complexity, gravel placement for spawning habitat, and the use of best management practices in riparian corridors and the Streamside Management Zone. The specific goals, objectives, standards, and guidelines that address all aspects of species management as it related to forest management activities are found in chapters 2 and 3 of the proposed Plan.

The Forest prioritizes management for federally listed species and the proposed Plan details specific management goals, objectives, standards, and guidelines for each. These address all aspects of species management as it related to forest management activities. The goals, objectives, standards, and guidelines for each listed species are outlined under Forest-wide and Management Area direction later in this document.

2800 MINERALS AND GEOLOGY

The geologic environment on the Forest provides a variety of minerals that are economically important. Common variety minerals like borrow sand, clay and gravel are found in the glacial deposits. There are also deposits of industrial sand and reported traces of placer gold. Gypsum, anhydrite and coal can be found under the thick covering of glacial deposits. While these deposits exist, their depth under the Forests presently makes them uneconomical to mine. Deeper in the bedrock are deposits of salt, potash and associated chemical stocks. Some could be extracted by solution mining or as natural brines.

In general, lands of the Forest lands are open to mineral exploration. Exploration, development, production of mineral and energy resources, and reclamation activities are part of the Forest Service's management responsibility. The Forest Service administers its minerals program to

provide commodities for current and future generations commensurate with the need to sustain the long-term health and biological diversity of ecosystems (Forest Service Minerals Program Policy). The Forest Service policy is consistent with the federal government’s policy outlined in the Mining and Minerals Policy Act of 1970.

There are approximately 480,000 acres of federally owned oil and gas on the Forest. Almost all of this acreage has, at one time or another, been leased, and much of this acreage has also been explored or developed. Currently, there are 77 authorized federal leases on the Forest, covering approximately 60,000 acres. Pending federal lease applications across the Forests total approximately 18,000 acres. In addition to federal mineral leasing, there are currently 758 State of Michigan oil and gas leases covering approximately 33,000 acres of state mineral interest on the Forests. Currently, there are 32 producing oil and gas wells on National Forest System lands within the Forests’ boundaries. These wells are producing federal, state, and/or private oil and gas resources. Sand and gravel production from several pits on the Forests is sporadic, averaging approximately 10,000-20,000 total cubic yards per year.

The proposed Plan includes the potential for increased oil and gas development on the Forest. The Forest must recognize privately-owned mineral rights on the Forest are recognized, and reasonable access for exploration or extraction are provided. The proposed Plan’s Standards and Guidelines identify what areas are and are not available for exploration and development, and if available, under what conditions (Table 5). Under the proposed Plan, less than one percent of the mineral interest on the Forest will be classified as “not available” for oil and gas exploration and development and approximately 21% of the Forest’s acreage would be classified as “no surface occupancy.” A lease notice associated with sensitive wildlife, such as Karner blue butterfly and Kirtland’s warbler, would state that operations would be subject to more restrictive species-specific controls. However, this would still permit occupancy and would not be a constraint that would further limit exploration and development. The Nordhouse Dunes Wilderness Area is statutorily withdrawn from oil and gas leasing.

Table 5. Total Acres Available for Leasing by Lease Stipulation Category.

Lease Stipulation Category	Acres
Not Available	3,380
No-Surface Occupancy	204,631
Other Restrictions (total)	419,266
• Controlled Surface Use 1 well per 640 Acres	44,376
• Controlled Surface Use 1 well per 160 Acres	12,426
• Kirtland's Warbler Restriction	66,676
• Old Growth Restriction	86,952
• Wildlife Area/Karner Blue Butterfly	208,836
Standard Stipulations	345,257
Total National Forest System Lands	973,107

Mineral management on the Forest is complicated by the mineral ownership patterns. Approximately 50 percent of the oil and gas resources found under National Forest System lands within the Forests' boundary are administered by the federal government. Approximately 40 percent are considered to be split-estate and are administered by the State of Michigan, with the remaining 10 percent being owned by private entities. Regulation on the development of these mineral rights varies depending upon the mineral owner and when the minerals were severed from the surface estate. For exploration and development of federal minerals, operators must acquire federal and state drilling permits, and operations are regulated at both the federal and state level. For exploration and development of state and private minerals, state regulations, non-discretionary federal law, and the mineral severance deed language control how operations are conducted. Depending upon the date and status of the minerals reservation, a permit from the Forest Service may or may not be required.

Common variety minerals, including sand, clay, and gravel, are found in glacial drifts on the Forests. There are also deeper mineral deposits of gypsum, anhydrite, coal, salt, and potash; however, the mining for these minerals is not economical due to the depth of overburden. Sand mining on the Forest is greatly restricted by state Critical Dunes designations that prohibit sand mining and by HMNF regulations that prohibit such activities within 300 ft (91 m) of a water body (USDAFS 2003a). Gravel mining occurs in 2 locations on the HMNF (K. Ennis, USFS, pers. comm. 2003) including the Three Lakes Pit (T25N, R4E, Sec. 21, SESW), which is approximately 11 ac (4 ha) in size. Luke's Corner (T20N, R14W, Sec. 26, NENE), the other active gravel pit on the Forest, is approximately 20 ac (8 ha) in size. Additional gravel sales are not anticipated and this pit is in the process of being closed and reclaimed.

Additional discussion of the Forest's potential for mineral and geology resource development is found in Appendix E of the proposed Plan.

3400 FOREST PEST MANAGEMENT

Native forest pests that have recently caused mortality include the fungus pine tip blight (*Sphaeropsis sapinea*), the jack pine budworm, oak wilt, and oak decline. In 2000 through 2002 there was an increase in the incidence of pine trees infected with the pine tip blight. The fungus attacks all native pines, but red pine is most susceptible. The fungus readily kills seedlings, but large trees can be killed or deformed by repeated attacks. The disease is spread by water-borne spores. A common situation is infection of planted red pine under a jack or red pine overstory. The overstory trees act as an infection source and the spores are spread by rain. In recent years the disease has impacted young jack pine on droughty sites. Droughts, from the mid 1990's through 2001, stressed young jack pine, making them more susceptible to the fungus. Jack pine regeneration on poor sandy soils had lower than normal survival. The return of normal rainfall since 2001 has led to a cessation of mortality attributable to *Sphaeropsis sapinea*.

The jack pine budworm population has been on the increase since 2001. The budworm is cyclic: populations buildup in stands with a high percentage of staminate flowers, poorly stocked stands, and in mature and over-mature jack pine. The population is expected to decline within a few years.

Oak wilt (*Ceratocystis fagacearum*) is a fungal disease that is widespread in eastern North America. The red oak group is most susceptible to this disease. Infected red oak may die within a month of infection. White oaks are less susceptible and usually do not suffer mortality but may have dieback on branches. Several pockets of oak wilt have been identified on the Mio Ranger District, most of them associated with residences and subdivisions in the Loon Lake, Mio, and Fairview areas.

Oak decline has occurred over widespread areas of the Forests. Oak decline is caused by the interaction of stresses and pests. Drought and other environmental factors stress the trees and make them susceptible to attack by insects and diseases. The two pests most commonly associated with oak decline are the two-lined chestnut borer, *Agrilus bilineatus*, and armillaria root rot, *Armillaria mellea*. Both red oak and white oaks are susceptible to oak decline, but may not be affected at the same time due to variation in stressors and forest pest populations. Northern pin oak on the Huron National Forest showed significant decline in 2003 and 2004.

The most important non-native insects and diseases threatening forest vegetation are gypsy moth (*Lymantria dispar*); Dutch elm disease fungus (*Ophiostoma ulmi* Buism. Nannf. - formerly called *Ceratocystis ulmi* and *Ophiostoma novo-ulmi* Brasier), spread by either the native elm bark beetle (*Hylurgopinus rufipes* Eich.) or the smaller European elm bark beetle (*Scolytus multistriatus* Marsh.); emerald ash borer (*Agrilus planipennis*); Asian long-horned beetle (*Anaplophora glabripennis*); butternut canker (*Sirococcus clavigigenti-juglandacearum*); and beech bark disease, which results when bark, attacked and altered by the beech scale (*Cryptococcus fagisuga* Lind.), is invaded and killed by the beech bark disease fungi, primarily *Nectria coccinea* var. *faginata* Lohman, Watson, and Ayers, and sometimes *N. galligena* Bres.

The gypsy moth and Dutch elm disease fungus infest every acre of the Forests where oaks and elms are present. Beech bark disease currently infests several thousand acres in Mason, Manistee, Oceana and Wexford Counties. Emerald ash borer infestations occur in Alcona and other southern Michigan counties; the Agriculture Plant Health Inspection Service and Michigan Department of Agriculture (and other state agencies) are currently attempting to eradicate this species in Michigan and the eastern United States. Butternut canker infects this species throughout its native range, but the population of butternut trees is low on the Forests. The Asian long-horned beetle has not been found on the Forests, but eradication and monitoring programs are on-going as close as the greater Chicago area.

There are currently 60 plants listed as non-native invasive species of concern for the Forest. Each species has an associated management goal ranging from immediate eradication to preventing invasion in non-infested areas. The Forest's list also includes plant species not yet found but expected to arrive in the near future. The list is a working document that will change to incorporate additional species not yet identified as non-native invasive species. Management goals are also likely to change based on new information.

A complete inventory of the Forests to assess the amount of acreage infested with invasive plant species has not been completed. The most likely areas of infestation include roadside habitat, areas of disturbance in sandy soils, and suitable riparian habitats. When the number of acres in

landtype associations having these characteristics is considered, it is estimated that over 100,000 acres of the Forests are likely to be infested with invasive plants.

Numerous other insect and disease problems are present, but do not represent a high potential for widespread damage.

The proposed Plan includes an Integrated Pest Management approach, requiring a comprehensive systems approach to achieving economical pest control in an environmentally acceptable manner. Individual components of integrated pest management include cultural, mechanical, biological, and chemical means of control. Guidelines allow for pesticides use in vegetative management, fisheries management, or to suppress insects and disease infestations when their use is cost efficient, biologically effective and environmentally acceptable. The Forest will establish untreated zones adjacent to water bodies and other sensitive areas, where necessary. The zone distance will depend on the type of pesticide proposed for use, methods of application, and the environmental sensitivity of the area, but the minimum distance will be 100 feet.

5100 FIRE MANAGEMENT

In general, the proposed Plan increases the acres and size of prescribed burns and fuel reduction, establishes priorities for fire suppression and fuels reduction., decreases effects of suppression activities, implements rehabilitation activities in burned areas and treats fuels, encourages native vegetation, and uses smoke management practices.

Wildfires set by visitors or natural causes burn an average of 2,360 ac (955 ha) annually on the HMNF (K. Ennis, USFS, pers. comm. 2003). Many of the vegetation types on the HMNF, such as prairie grass systems, oak savannahs and oak-pine barrens, are especially susceptible to fast-moving, high-intensity forest fires (USD AFS 2001). Jack pine stands are of particular fire concern on the HMNF because their low-moisture and volatile chemical composition, coupled with their arrangement on the landscape, tends to encourage fire (USD AFS 2001). Furthermore, the generally flat terrain of the HMNF tends to facilitate the spread of wind-driven fires; a condition exacerbated by frequent high wind events off of Lake Michigan (USD AFS 2001).

Prescribed burning is a particularly useful management tool in pine barren, oak savannah, and dry sand prairie on the Forest. Most prescribed fire activities will be of low to moderate intensities in association with wildlife opening maintenance, fire dependent ecosystem restorations, and fuels projects to reduce the risk of catastrophic wildfires. Prescribed fire is also an essential tool used to maintain habitat for the Kirtland's warbler and Karner blue butterfly. Burning programs for improvement of wildlife habitat will continue to be a priority for these and other species where necessary on the Forest. Roughly 3,000 to 6,000 acres will be annually burned with prescribed fire during the first decade. Prescribed fires will be of low to moderate intensities.

Prescribed burns require preparation of burn plans. Burn plans outline a range of conditions under which a burn would be conducted in order to minimize potential adverse impacts. In addition, these plans minimize smoke and particulate matter in sensitive areas. Particulate output

from prescribed fire activities is usually below EPA thresholds. Prescribed burns normally produce fewer particulates than wildfire because of the controlled conditions under which they are ignited.

Increasing stand age, hazardous fuels build-up, and increasing urban encroachment has increased the potential for large-scale catastrophic fires on the HMNF (USDAFS 2001). The Forest is engaged in a hazardous fuel reduction program that includes prescribed burning and mechanical fuel reduction methods. Large areas are burned under strict controls to reduce fuel accumulation and re-introduce fire's role in ecosystem functioning. Fuelbreaks that provide a break in the continuity of flammable vegetation are also being constructed and maintained. These activities result in forest conditions that can reduce the intensity of wildfires and allow fire suppression efforts to be more successful. The proposed Plan includes treatment of approximately 8,000 acres of hazardous vegetation types per year and creation of 2,000 acres of fuelbreaks per year to lower the fire hazard to communities-at-risk.

7700 TRANSPORTATION SYSTEM

Principal access routes to the Huron National Forest are Highways M-72 and M-55 from the east and west, and Highways I-75, M-33, M-65, and US-23 from the north and south. Principal access routes to the Manistee National Forest are Highways M-55, US-10, and M-20 from the east and west and Highways US-131, M-37, and US-31 from the north and south.

An estimated 10,400 miles of road currently exist within the Forests' boundaries, resulting in an average road density of 3.2 miles per square mile. Of these roads, approximately 6,997 miles (67%) are two-lane improved roads, and approximately 3,403 miles (33%) are single-lane unimproved primitive or minimally improved travelways. The majority of the total miles are operated by the state or counties (6,670 miles; 64%), and the remainder (3,730 miles; 36%) are National Forest System roads.

The 3,730 miles of National Forest roads are classified by five maintenance levels:

- Maintenance Level 1: Roads that are closed and not maintained.
- Maintenance Level 2: Roads that are maintained for high clearance vehicles.
- Maintenance Level 3: Roads that do not have smooth surfaces and are maintained for passenger vehicles.
- Maintenance Level 4: Roads that have smooth surfaces and are maintained for passenger vehicles.
- Maintenance Level 5: Roads that are possibly paved and dust free and have smooth surfaces and are maintained for passenger vehicles.

A breakdown of the National Forest roads is shown below (Table 6):

Table 6. National Forest Road Miles by Maintenance Level*

Forest	Level 1	Level 2	Level 3	Level 4	Level 5	Total
Huron NF	267	1117	252	16	1.5	1653.5
Manistee NF	220	1799	33	13.5	11	2076.5
TOTAL	487	2916	285	29.5	12.5	3730
% of TOTAL	13%	78%	7%	<1%	<1%	

* Forest-Scale Roads Analysis for the Huron-Manistee National Forests – November 2002, INFRA Database – September 2, 2004

In addition to authorized Federal, Forest, State, County and Township roads, there are many unauthorized, user-developed roads across the Forests. Since these are not designed roads, many are rutted and are in need of maintenance or repair. Due to the poor location of some of these roads, such as on steep terrains, portions of these roads are susceptible to erosion. Road/stream crossings, roadside erosion, and Off-Road Vehicle damage to the hillsides are the primary contributors to stream sedimentation and degraded water quality.

The proposed Plan increases the amount of semiprimitive management areas on the Forests. This change may require the closure of roads in some of these areas to more closely meet the desired condition for road density levels identified for semiprimitive areas. Transportation management would reduce road miles across the heavily roaded Forest.

The proposed Plan increases for restoration activities for a variety of wildlife species and habitats. In order to most effectively restore and conserve wildlife and plant species and habitats, some roads may be obliterated in order to restore habitat. Some roads may also be closed to public vehicular use or roads may be restricted by vehicle type or season of use.

In general, the proposed Plan will decrease the number road miles across the Forest. Management activities on the Forests generate road use because most activities require motorized access. However, some of the Forest activities, such as timber harvesting and recreation, will continue to generating road use. High standard passenger car roads (maintenance levels 3 to 5) are unlikely to be closed or decommissioned, although they make up a relatively small proportion of the total road miles. Smaller low standard maintenance level 2 roads, which make up the majority of the road miles, are more likely to be closed. These closures would not have a significant effect on access for developed recreational. However, access for dispersed recreational activities, such as hunting and dispersed camping, would decrease. An appropriate level of access would continue to be provided across the Forest for management purposes, recreational activities, and general public use.

2. Forest-wide Management Area Direction

According to the Forests' Land and Resource Management Plan, the Plan guides all natural resource management activities that occur on the Forests. It describes desired resource conditions, resource management practices, levels of resource production and management, and the availability of suitable land and resource management. The purpose of the Plan is to provide

management direction to ensure that ecosystems are capable of providing a sustainable flow of beneficial goods and services to the public.

The Plan provides desired Conditions, Goals, Objectives, Standards, and Guidelines that direct implementation of the forest management activities outlined in the previous section of this document (1. Management Activities). Goals and Desired Conditions are broad statements that describe the situation that the Forest Service will strive to achieve. Goals are broad statements of the Forests' overall purpose, while desired conditions describe what the Forests should look like in the future. Objectives are measurable steps taken within a specified timeframe to move toward a desired condition. Standards and Guidelines are the specific technical direction for managing resources. Standards are required limits to activities. Deviations from Standards must be analyzed and documented in Forest Plan amendments. Guidelines are preferable limits to management actions that may be followed to achieve desired conditions. Guidelines are generally expected to be carried out and any deviation from Guidelines must be analyzed during project-level analysis and documented in a project decision document, but these deviations do not require a Forest Plan amendment.

In chapter 2 of the proposed Plan, the Forest establishes numerous Forest-wide desired conditions, goals, objectives, standards, and guidelines. Only those that pertain directly to listed species are summarized below.

Forest-wide, the Plan establishes the following Desired Conditions:

- 1- All management activities provide for safe conditions for the public and employees.
- 2- Recreation management provided is compatible with the Recreation Opportunity Spectrum objectives.
- 3- The North County National Scenic Trail is constructed and administered as a premier hiking and backpacking trail. The trail will highlight significant scenic, historic, natural and cultural qualities.
- 4- Designated National Wild, Scenic, and Recreation Rivers are managed according to the management plan for the individual river.
- 5- The total of early successional habitat less than or equal to 15 years, and open-land habitat, such as agricultural, urban development and roads, should generally not exceed 66 percent of the area within any 6th level watershed on the forests. In most cases, 6th level watersheds have an area up to 40,000 acres associated with a creek and tributary.
- 6- Areas with unique character are protected.
- 7- Prairies, savannahs, and oak-pine barrens have been restored and maintained on approximately 10,000 acres within old-growth areas.
- 8- Maintain favorable conditions of water flow and quality. Management practices will not result in a long-term decline in water quality conditions.
- 9- Indiana bat, Karner blue butterfly, bald eagle, Kirtland's warbler, piping plover and Pitcher's thistle are managed according to their recovery plans.
- 10- Severe and moderately eroding streambanks are restored.
- 11- Habitat needs of riparian-dependent species are met and that habitat is maintained, especially habitat for threatened, endangered and sensitive species.

12- The cumulative amount of streamside stabilization over time does not exceed five percent of the total shoreline length of a river system within National Forest System boundaries.

13- In-stream large woody debris meets objectives stated in Table 7.

Table 7. Desired Future Condition for Large Woody Debris

Stream Order	Number of Large Woody Debris Structures per 300 Feet of Stream
1-2	6-9 (108-160 per mile)
3-4	3-6 (54-108 per mile)

Vegetation Composition objectives for the end of the first decade are displayed in Table 8.

Table 8. Vegetation Composition Objectives (End of First Decade).

Vegetation Class	Huron National Forest (%)	Manistee National Forest (%)
Aspen/Birch	16-22	10-16
Barrens and Savannahs	1-3	2-5
High-Site Oaks	5-11	15-21
Lowland Conifers	2-8	0-5
Lowland Hardwoods	1-4	4-10
Long-Lived Conifers	15-21	17-23
Low-Site Oaks	12-18	13-19
Northern Hardwoods	2-8	8-14
Openings	4-9	4-10
Short-Lived Conifers	18-24	2-8

In pages II-3 to II-6 of the Plan, the Forest establishes numerous Forest-wide Goals and Objectives. The list below details those goals and objectives that are most pertinent to listed species on the Forest.

Health and Safety

- Suppress wildfires using an appropriate management response, in a manner compatible with Management Area objectives. Prevention, pre-suppression and suppression activities will be based on analysis of past fire occurrence, fire intensities and values at risk.
- Encourage adequate fire prevention, fire-safe construction and presuppression activities on private lands in wildland/urban interface fire prone areas.
- Fire suppression activities should be the least impacting to the environment while providing for safety, but still achieve the objectives of fire suppression.
- Suppress fires occurring on private lands inside the Forests' fire protection boundary as defined under established agreements.
- Create agreements for fire detection and suppression on National Forest System lands with cooperating firefighting agencies to define suppression actions commensurate with established resource management prescriptions.
- Fire use is suitable on National Forest System Lands. Fire use will, to the extent possible, mimic natural processes to accomplish resource objectives, while protecting wilderness values and cultural, historical, and developed resources.

- Implement fuels reduction and fuelbreak projects where conditions warrant for the protection of life, property, and safety. High-risk areas adjacent to private land will receive treatment priority.
- Provide for the protection of National Forest System lands and for the property and safety of users.
- Provide for Law Enforcement and compliance patrols based on user activity and resource protection needs.
- Maintain a transportation system that meets health and safety, resource, and administrative needs.

Public Relations and Partnerships

- Implement a public information and education program to explain areas of special significance in coordination with other public and private organizations to reduce the number, intensity, and cost of conflict-producing resource-damaging situations.
- Use a combination of personal contacts, brochures, maps and informational signing to inform and educate users about forest management.

Natural Resources

- Monitor and evaluate the effectiveness of management practices.
- Manage designated old growth across all management areas and vegetation classes emphasizing old growth characteristics.
- Meet species viability needs, achieve fire hazard reduction, and accomplish fiber production from regulated (Allowable Sale Quantity) and non-regulated (non-chargeable) forest lands primarily through timber harvest.
- Monitor wildlife responses to management practices using identified Management Indicator Species to determine the effects of management on fish and wildlife populations.
- Wildlife and fisheries habitats and plant communities shall be managed to maintain viable populations of existing native and desired non-native species.
- Maintain or improve the populations of endangered, threatened or sensitive species or communities.
- Manage the 5-mile (8 km) radius around Tippy Dam to benefit the Indiana bat.
- Restore and maintain savannahs, prairies, dry grasslands, mesic grasslands, shrub/scrub and oak-pine barrens in areas where they were known to previously occur, to provide for habitat diversity and to meet species viability needs.
- Utilize prescribed fire to meet management direction as appropriate for the ecosystems involved.

In chapter 2 of the proposed Plan, the Forest establishes numerous Forest-wide desired conditions, goals, objectives, standards, and guidelines. **Those that pertain directly to listed species are summarized below.**

2300 RECREATION, WILDERNESS AND RELATED RESOURCE MANAGEMENT

VIII. Trails

D. Off-Highway Vehicles, Including Snowmobiles

3. Do not permit motorized vehicles in essential habitats for endangered, threatened and sensitive species. (Guideline)

2500 WATERSHED MANAGEMENT

I. Water

A. Guidelines for Management Activities

1. Riparian Vegetation Management

- a. If natural disturbance processes are not providing adequate habitat within the Streamside Management Zone for threatened, endangered, sensitive, and other species with viability concerns, active management for early successional habitat may be implemented on a case-by-case basis. (Guideline)

2600 WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT MANAGEMENT

I. General Management (Guidelines)

A. Sparta soils series on the Manistee National Forest should be managed as prairies.

B. Forested

1. Snags, den trees, mast trees and down wood:

- a. Provide snags, den trees, mast trees and down wood to meet requirements of indicator species and to maintain viable vertebrate populations. Table II-12 in the proposed Plan displays numbers of snags, den trees, mast trees and down wood as per acre minimums and minimum size objectives. Size objectives are minimums, and the largest diameter trees practical should be used. These do not apply to management areas 5.1, 8.2, 8.4 and 9.1.
- b. In regeneration harvests, leave den and mast trees in clumps, if available.

II. Endangered and Threatened Species and Their Management (Species not addressed here are covered in individual management area sections in Chapter III) (Guidelines unless otherwise noted)

A. Federally endangered, threatened, and proposed species management will take precedent over old growth goals, objectives and Standards and Guidelines.

B. Sensitive species management will take precedent over old growth goals, objectives and Standards and Guidelines only when there are no other opportunities to provide for the needs of these species elsewhere.

C. Indiana Bat (applies in all management areas within designated Indiana bat habitat except 5.1, 8.2, and 9.1, unless otherwise noted).

1. Appropriate protection measures for site-specific projects will be developed during biological evaluations. Exceptions to the project-specific measures include:

- a. Allow initial thinning treatments in fully or over-stocked red pine plantations.
- b. Allow salvage harvest of small areas, less than 5 acres, of red pine.
- c. Allow removal of trees that pose a safety hazard in recreation, trails, special use, and administrative sites and road rights-of-way that are not presently being used by Indiana bats. If a bat is present, consultation will occur with the U.S. Fish and Wildlife Service.
- d. Allow removal of trees less than six inches diameter breast height.
- e. Allow removal of trees in areas surveyed for bats with U.S. Fish and Wildlife Service approved survey techniques where no bats or suitable habitat were found.

2. Where vegetation management occurs, an average of nine high quality summer roost trees-snags or live trees greater than nine inches diameter at breast height, per acre will be maintained within the treated acres. Leave trees 16 inches diameter at breast height or greater, where available. If not available, leave trees 9 to 16 inches diameter at breast height. If necessary, leave trees 3 to 9 inches diameter at breast height. When selecting roost trees, emphasize the applicable selection criteria below:

- a. As many standing snags greater than three inches diameter at breast height as practical within regeneration and timber management units. Retain live trees around larger snags to provide protection from wind throw; give preference to retaining oaks and hickories; if individual trees are a health or safety concern, consider grouping them or protect zones around them.
 - 1. Give preference to larger snags; retain all snags greater than 16 inches diameter at breast height.
 - 2. Snags should be retained regardless of species.
 - 3. Ensure that care is taken during site preparation, seeding, etc., to avoid damage or loss of retained snags.
- b. Standing live trees greater than three inches diameter at breast height with greater than 25 percent exfoliating bark, regardless of species.
- c. Hollow, den and cavity trees greater than nine inches diameter breast height as practical, regardless of species.
- d. Shagbark and bitternut hickories, regardless of size, and regardless of whether dead or alive, if available.
- e. When few snags are available or cannot be left, leave at least nine of the largest live trees on site, preferably greater than 26 inches diameter at breast height, in the Class I Category-oaks and hickories; other desirable species include eastern cottonwood, green and white ash and American and slippery elm.
- f. Leave seed trees uncut in seed-tree harvest areas, particularly in areas of oaks and hickories. Retain the largest trees as seed trees in order to ensure a component of large, over-mature trees.
- g. In individual and group selection harvests:

1. Ensure that a component of large, over-mature trees remains to provide suitable roosting habitat -- retaining at least three live trees per acre greater than 20 inches diameter at breast height.
2. If there are no trees greater than 20 inches diameter at breast height, retain 16 of the largest available trees per acre.
3. When available, trees left should be Class I type trees-oaks and hickories; other desirable species include eastern cottonwood, green and white ash and American and slippery elm.
3. Prohibit removal of standing dead trees for firewood between May 1 and August 31. The Forest will annually update the firewood cutting maps to identify areas that are off limits. (Standard)
 - a. Within the five-mile radius around Tippy Dam-Tippy Management Zone, firewood permits will be prohibited.
4. Generally, prescribed burns are prohibited within designated Indiana bat habitat between May 1 and August 31 (applies in all management areas).
5. Prescribed burns and vegetation management in the five-mile radius around Tippy Dam-Tippy Management Zone, are to be conducted, as feasible and prudent, outside the spring staging period from May 1 to June 15, and the fall swarming period from September 1 to October 20.
6. In optimal summer maternity habitat, conduct vegetation management and prescribed fire, as feasible and prudent, outside summer maternity period from May 1 to August 31.
7. In optimal summer maternity habitat, individual projects may proceed during the summer maternity period if surveyed for Indiana bats, according to protocols established by the U.S. Fish and Wildlife Service, prior to project implementation. (Standards)
 - a. If a reproductive female Indiana bat is found, postpone project activities that may affect Indiana bats until outside of the summer maternity period.
 - b. If no Indiana bats or only male bats or non-reproductive female bats are found, the project may proceed using the established conservation measures and operating procedures committed to in the biological assessment. Mist netting results are valid for a three-year period only. If a project has not been completed within this time frame, a new survey will be required.
8. Protection zones will be established around maternity colonies where discovered. (Standard)
9. Upland water sources will be provided for the Indiana bat by:
 - a. Developing water holes in wildlife openings along the forest edge.
 - b. Utilize maintenance level 1 and decommissioned roads to provide upland water sources, where feasible.
 - c. Designing road construction and reconstruction projects to include small waterholes adjacent to the road, where feasible.

D. Bald Eagle

1. Implement the Bald Eagle Management Plan for the Huron-Manistee National Forests (USDA-Forest Service, 1996, or current version).

2. Federal oil and gas leases will contain a no-surface-occupancy stipulation for areas within 1,320 feet of a bald eagle's nest.

E. Kirtland's Warbler

1. See 2600, Management Indicator Species and Chapter III, Management Area 4.2, for Standards and Guidelines.

F. Great Lakes Piping Plover and Critical Habitat

1. See Chapter III, Management Areas 4.2, 4.3, 5.1 and 8.2 for Standards and Guidelines.

G. Karner Blue Butterfly

1. Implement the Karner Blue Butterfly Recovery Plan (USDI-Fish and Wildlife Service, 2001, or current version). (Standard)

2. Resource management activities, such as road and trail construction and vegetation management, will be designed to protect and improve potential Karner blue butterfly habitat.

3. Roads and trails may be relocated or decommissioned, as deemed necessary, to protect wild lupine.

4. The following applies to unoccupied potential habitat (Standard):

a. Conduct pre-activity surveys to determine presence/absence of the species. If the species is found, the Forests will follow the Standards and Guidelines for occupied habitat.

5. The following applies to occupied habitat areas:

a. Conduct pre-activity surveys. (Guideline)

b. Use woodland strips or brush piles along trails and roads to prohibit Off-Highway Vehicle use. (Standard)

c. Direct camping to areas outside occupied habitat. (Guideline)

d. Camping will be prohibited in occupied areas where posted. (Standard)

e. Oil and gas development will contain a no-surface-occupancy stipulation and will exclude road building. (Standard)

f. The application and use of herbicides or pesticides is prohibited adjacent to occupied Karner blue butterfly habitat between April 1 and August 15, unless the following conditions are met (Standard):

1. The wind is not blowing toward the habitat and there is a minimum buffer of 100 feet between the habitat and the treatment area.

g. Maintain or restore occupied Karner blue butterfly sites by (Guideline):

1. Providing savanna-like conditions with 25 to 50 percent crown closure or openings with an abundance of wild lupine.

2. Maintaining savannah-like conditions by removing woody encroachment.

3. Provide dispersal corridors in order to facilitate dispersal between occupied and unoccupied areas-suitable habitat sites.

4. Prohibiting the cutting of trees between March 15 and August 15. Cutting is restricted to a four-year frequency. Allow cutting of trees that pose a safety hazard.
5. Locating logging roads, skid trails, and log yards to avoid or minimize impact to the habitat.
6. Cutting trees with equipment such as chainsaws is preferred. Other mechanized tree cutting equipment may be allowed by exception.
7. Piling slash not to exceed 20 percent of an area, burning slash piles during the winter and avoiding piling slash in areas containing concentrations of wild lupine.
8. Mowing and/or brush hogging activities are prohibited between March 15 and August 15.
 - a. Divide areas into at least two units, each of which supports lupine and nectar sources. At least one unit will remain untreated each season unless there is a colonization source within one-fourth mile that has the capability to recolonize this area.
 - b. Leave cut vegetation on site that may contain eggs, unless the cut vegetation is collected and placed in another suitable habitat site.
- h. Prescribed burning will be conducted by (Guidelines):
 1. Dividing sites into at least three burn units based on numbers of butterflies and burn no more than one-third of any site in any one year. If there are less than 10 individual butterflies during the first flight survey, then the entire site can be burned.
 2. Keeping unburned occupied patches within one-fourth mile of burned patches to aid recolonization.
 3. Designing burn areas with irregular shapes and small-scale unburned vegetation-skips.
 4. Having an approximate four-year burning frequency.
- i. Site scarification will be conducted by (Guidelines):
 1. Exposing mineral soil to aid seeding of native nectar plants.
 2. Leaving 25 to 50 percent of the occupied area undisturbed.
 3. Protecting concentrations of wild lupine or other nectar plants.
 4. Treating areas will be prohibited between March 15 and August 15 and on a four-year frequency.
- j. Propagating nectar plants by using seeds with a locally based genotype when possible. If collected from the site, limit the collection to no more than 25 percent of available seeds and collect after July 1.

- H Pitcher's Thistle
1. Prohibit new resource development and mining in occupied Pitcher's thistle habitat.
 2. Prohibit surface occupancy within 300 feet of Lake Michigan, except for reserved and outstanding mineral rights.
 3. Herbicide use will occur only when other methods of control for specific non-native invasive plant species are ineffective or cost-prohibitive.
 4. Prohibit dune stabilization activities in Pitcher's thistle habitat (Standard).
 5. Roads into Pitcher's thistle habitat on National Forest System lands will be closed when appropriate.
 6. Limit the use of prescribed burning in dune habitat where Pitcher's thistle occurs.
 7. Limit foot traffic within specific areas of the dune ecosystem where Pitcher's thistle occurs.

IV. Management Indicator Species

A. Bald Eagle

1. Habitat and Population Objectives: Habitat and population objectives are in accordance with the Northern States Bald Eagle Recovery Plan and the Bald Eagle Management Plan, Huron-Manistee National Forests. Habitat objectives include the protection of essential habitat, protection from environmental contamination and habitat acquisition.
2. Conservation Activities: In accordance with the Bald Eagle Management Plan, conservation activities include:
 - 1) protection of nesting territories; 2) developing management plans for each nesting territory; 3) protection of potential nesting territories/ and 4) protection of feeding, roosting and wintering areas.
3. Monitoring: The population trend of the bald eagle will be monitored annually to determine the status and productivity of breeding areas.
4. Evaluation of Monitoring Results: Monitoring information will be evaluated every one to five years.

B. Karner Blue Butterfly (Guidelines)

1. Habitat and Population Objectives: Habitat and population objectives follow recommendations of the Karner Blue Butterfly Recovery Plan (U. S. Fish and Wildlife Service, 2003, or as updated). Three large viable populations—6,000 butterflies, and one viable population 3,000 butterflies, will be established and maintained on the Manistee National Forest. As such, 20,300 acres of barrens habitat will be developed and maintained in the four metapopulation areas and the essential Karner blue butterfly barren habitat on the Manistee National Forest. Information detailing locations and specific habitat requirements associated with Karner blue butterfly essential habitat can be found in the Biological Assessment for this Forest Plan, the Karner Blue Butterfly Recovery Plan (2003, or current version), the Karner Blue Butterfly Habitat Management Strategy and the Karner Blue Butterfly Species Viability Evaluation for the Huron-Manistee National Forests (2004 or current version)..

2. Conservation Activities: In accordance with the Karner Blue Butterfly Recovery Plan, conservation activities include:
 - a) Protect and manage the Karner blue and its habitat to perpetuate viable metapopulations;
 - b) Evaluate and implement translocation where appropriate;
 - c) Develop range-wide and regional management guidelines;
 - d) Develop and implement information and education program;
 - e) Collect important ecological data on Karner blue and associated habitats;
 - f) Review and track recovery progress.
3. Monitoring: The population trend of the Karner blue butterfly and its relationship to habitat changes will be monitored on an annual basis.
4. Evaluation of Monitoring Results: Monitoring information will be evaluated every 1 to 5 years.

C. Kirtland's Warbler (Guidelines)

1. Habitat and Population Objectives: Habitat and population objectives are in accordance with the Kirtland's Warbler Recovery Plan (Byelich et al. 1985) and Strategy for Kirtland's Warbler Habitat Management (Huber et al. 2001).
2. Conservation Activities: Conservation activities are centered on:
 - a) ensuring the availability of breeding habitat;
 - b) controlling human activity and disturbance within habitat during the breeding season; and
 - c) Reducing nest parasitism by the brown-headed cowbird.
 These activities are incorporated into Chapter III of the Forest Plan Standards and Guidelines.
3. Monitoring: The population trend of the Kirtland's warbler and its relationship to habitat changes will be monitored on an annual basis.
4. Evaluation of Monitoring Results: Monitoring information will be evaluated annually.

5100 FIRE MANAGEMENT

I. Suppression

- B. Minimize use of tractor plows, retardant, constructed helispots, and wheeled vehicles within old growth areas, known heritage sites, and endangered, threatened and Regional Forester's Sensitive Species areas. (Guideline)

3. Management Areas

The HMNF has 16 different management areas (MA; Table 9). The MAs are areas of the HMNF that have common management direction, with one management prescription applied to achieve the desired future condition of the land. Management prescriptions are sets of practices designed to create this desired future condition. Selection of the proper prescription requires matching its suitability and capability to produce a mix of goods, services, and desired uses with the attributes of an area. Assignment of management prescription areas on the HMNF reflects a wide variety

of ecological land type associations, vegetative conditions and recreation opportunities (USDAFS 2005 BA).

Table 9. Management Areas on the HMNF (USDAFS 2005 Plan).

Management Area	Title	% of Total Forest Acres
2.1	Roaded natural plains and morainal hills	17%
4.2	Roaded natural sandy plains and hills	42%
4.3	Roaded natural wetlands	12%
4.4	Rural	13%
5.1	Wilderness	<1%
6.1	Semiprimitive Nonmotorized Area	6%
6.2	Semiprimitive Motorized	2%
7.1	Concentrated Recreation Areas	<1%
8.1	Wild and Scenic Rivers	2%
8.2	Research Natural Areas	<1%
8.3	Experimental Forests	1%
8.4	Special Areas	<1%
9.1	Candidate Research Natural Areas	1%
9.2	Wild and Scenic Study Rivers	1%

The following section discusses each MA that contains habitat for listed species. This includes all MAs except for 7.1 and 8.4. For each MA, we summarize the Desired Conditions, Goals, And Objectives. In chapter 3 of the proposed Plan, the Forest establishes numerous desired conditions, goals, objectives, standards, and guidelines for each MA. Only those that pertain directly to listed species are summarized below.

MA 2.1- Roaded natural plains and morainal hills

This MA is found on morainal hills and gently rolling plains where soils support northern hardwoods, aspen and conifers. Management activities provide high volumes of quality hardwood timber products and firewood with special consideration for enhancing wildlife habitats. Emphasis is given to managing grouse, deer, wildlife emphasis areas and fish habitat. A broad variety of recreational opportunities is available and visual diversity is high. The only federally listed species that potentially occurs in this MA is the Indiana bat.

Desired Conditions

- 1- Human activities are evident. There are restrictions and controls on the area's use. Users are aware of services provided, such as developed recreational sites, law enforcement and visitor information.
- 2- Land management practices such as vegetation management, facilities, structures, utility corridors and mineral exploration and development are evident. The area will provide roads and trails appropriate for motorized and nonmotorized uses. Road closures are evident.
- 3- Timber stands are dominated by red oak, sugar and red maples, beech, ash, black cherry and

aspen, with conifer inclusions of red and white pines. The dominant trees in stands are the same age and about the same size. Stands differ in age and are irregular in size and shape, giving the landscape a mosaic appearance. Openings are interspersed throughout the area. There are approximately 13,300 acres of designated old growth in this management area.

Goals and Objectives

- 1- Provide moderate amounts of motorized recreational opportunities.
- 2- Provide moderate amounts of nonmotorized recreational opportunities and a moderate number of developed recreation sites.
- 3- Provide a roaded natural recreational experience.
- 4- Provide fish habitat improvements.
- 5- Provide core mature mesic northern hardwood habitat necessary for species viability. Management will strive to increase utilization of wood residues and other currently non-merchantable material, when not needed for resource concerns such as soil productivity and wildlife habitat, for fuelwood and other special forest products.
- 6- Quality sites and opportunities for intensive timber management practices will be identified commensurate with the site's ecological capabilities.
- 7- Manage permanent openings and/or grasslands to meet species viability needs. Distribution of openings will recognize the contribution of adjacent private lands.
- 8- Manage for mesic grassland habitats.
- 9- Acquire, create and manage shallow water-emergent wetlands.
- 10- Provide opportunities for mineral exploration and development.

Standards and Guidelines most pertinent to listed species

No specific MA standards and guidelines. Refer to Forest-wide standards and guidelines.

MA 4.2- Roaded Natural Sandy Plains and Hills

This is the most abundant MA on the Forest, comprising 42% of the total Forest Service land area. Dry, sandy plains and low, dry, sandy hills that support red and jack pines, oak, and aspen typify this MA. Management activities enhance and increase the variety of wildlife habitats with emphasis given to managing deer, grouse, and wildlife emphasis areas. High volumes of softwood and hardwood timber products are produced. Emphasis includes reducing life-threatening and property-damaging wildfire potential and providing a variety of recreational opportunities.

A considerable portion of the dry sand outwash plains on the Huron Forest in this MA will be managed as essential habitat for the Kirtland's warbler. Management activities maintain and develop essential nesting habitat for the Kirtland's warbler in compliance with the provisions of Section 7 of the Endangered Species Act (P.L. 93-205) and as outlined in the Kirtland's Warbler Management and Recovery Plan. The federally listed species that potentially occur in this MA are the Indiana bat, Kirtland's warbler, Karner blue butterfly, Pitcher's thistle, and bald eagle.

Desired Conditions

- 1- Human activities such as vegetative management, facilities, structures, utility corridors, mineral exploration and mineral development are evident.
- 2- The area will provide roads and trails appropriate for motorized and non-motorized uses. Road closures are evident.
- 3- Timber stands are dominated by red, white, and jack pines; red, white, and black oaks; and aspen. The dominant trees in stands are the same age and about the same size. Stands differ in age and are irregular in size and shape, giving the landscape a mosaic appearance. Openings are interspersed throughout the area. There are approximately 27,700 acres of designated old growth in this management area.

Goals and Objectives

- 1- Provide opportunities for dispersed recreational opportunities.
- 2- Provide low amounts of developed recreational opportunities.
- 3- Provide for water-related recreational opportunities.
- 4- Provide a roaded natural recreational experience.
- 5- Provide vegetative age diversity in all vegetation classes.
- 6- Manage permanent openings and/or grasslands to meet species viability needs. Distribution of openings will recognize the contribution of adjacent private lands.
- 7- Manage for mesic grassland habitats.
- 8- Provide recreation opportunities consistent with essential habitat maintenance.
- 9- Fulfill the Forests' responsibilities in the interagency effort outlined in the "Strategy for Kirtland's Warbler Habitat Management."
- 10- Management will strive to increase utilization of wood residues and other currently non-merchantable material, when not needed for resource concerns such as soil productivity and wildlife habitat, for fuel wood and other special forest products.
- 11- Quality sites and opportunities for intensive timber management practices will be identified commensurate with the site's ecological capabilities.
- 12- Provide opportunities for mineral exploration and development.

Standards and Guidelines most pertinent to listed species

2300 RECREATION, WILDERNESS, AND RELATED RESOURCE MANAGEMENT

I. Kirtland's warbler (Guidelines):

- A. Occupied Kirtland's warbler habitats will be closed to public entry during the breeding and nesting seasons, except for approved tours.
- B. Closed areas and roads will be posted. Where necessary, roads will be gated.

III Trails

A. General Management (Guideline)

1. Do not construct new trails in Kirtland's warbler essential habitat.
2. Off-Highway Vehicles and motorcycle trails in essential habitat will be relocated to areas outside of essential habitat where possible.

3. Kirtland's warbler nesting habitat will not be developed within 100 feet of Off-Highway Vehicle and motorcycle trails that cannot be relocated outside of essential habitat.

- II. The following standards and guidelines apply only to the even-aged silvicultural system:
 - A. Temporary openings created by the application of the even-aged silvicultural system:
 - 2. Regeneration harvests will be 40 acres or less, except in Kirtland's Warbler Management Areas (Guideline)

2600 WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT MANAGEMENT

II Threatened and Endangered Species

A. Kirtland's Warbler (Guidelines)

- 1. Management of essential habitat will be consistent with the Strategy for Kirtland's Warbler Habitat Management, the Kirtland's Warbler Recover Plan and the guidelines below.
- 2. Develop Kirtland's warbler breeding habitat by designing and configuring treatment blocks that mimic the regeneration effects of wildfire.
- 3. Prepare treatment blocks for regeneration by clearcutting.
- 4. Treatment blocks will be no greater than 550 acres unless reviewed by the Regional Forester.
- 5. If temporary openings created by adjacent treatment blocks exceed 550 acres, one block will be stocked before the other is sold.
- 6. Harvesting of immature stands is permitted to create large treatment blocks.
- 7. Provide 15 to 25 snags per acre in treatment blocks. Table III-4 displays wildlife structure and forage prescriptions for Management Area 4.2KW.

Table III-4. Wildlife Structure and Forage Prescriptions by Vegetative Treatment for Management Area 4.2KW.

Structural Component	Regeneration Harvest		Intermediate Harvest	
	Number <u>1/</u>	DBH <u>2/</u>	Number	DBH
Snags	15-25	> 6	9	9
Mast/Den Trees (All Except)	4		4	
Down Wood	3	10	3	10
<u>1/</u> Numbers are per acre minimums. <u>2/</u> Diameter Breast Height (DBH) = Minimum size objectives are displayed. Diameters should be representative of the largest trees in the stand.				

- 8. The target jack pine seedling density is 1,452 or more trees per acre—5 x 6 spacing, over 75 percent of the treatment block, excluding planned openings.
- 9. Create openings in plantation and in treatment blocks that have regenerated naturally. Openings will be from 0.1 to .25 acre in size, and well distributed over 25 percent of the treatment block.

B. Piping Plover (Standard unless otherwise noted)

1. Active nest sites and areas used for raising young will be protected from human disturbance and pets. Pets will be required to be on a leash between April 1 and August 31 and at any time near an active nest.
2. The following access restrictions will apply from April 1 to August 31 and any time around active nest sites:
 - a. Except for emergency administrative use, vehicle traffic will be prohibited along the beach. Efforts will be made to coordinate emergency administrative use with individuals knowledgeable of nest sites.
 - b. Trail management and construction will direct the public away from active nest sites.
 - c. Pedestrians will be prohibited from leaving trails and entering nest site areas.
 - d. Kite flying will be prohibited within 650 feet of active nest site areas.
3. Signing and symbolic fencing, such as two strands of twine tied between posts, will be allowed to keep human activity at least 134 feet away from predator exclosures. If needed, a larger protection area may be designated. Fencing and signing will be installed using current acceptable procedures. (Guideline)
4. Where necessary, nesting and feeding areas will be protected from predators through predator exclosures and other proven devices and methods. Exclosures will be as follows: 5 feet between the nest and the predator exclosure, and 134 feet between predator exclosure and the psychological/symbolic fencing. Construction will occur at a time that does not subject the eggs to adverse weather during absence of adults. Fencing and signing will be installed using current acceptable procedures. (Guideline)

C. Pitcher's Thistle

1. See Chapter II, 2600 for Standards and Guidelines.

III. Wildlife Emphasis Areas (Guidelines)

B. Railroad Lake

1. Identify potential bald eagle nest and roost sites and protect these from development and other activities.

C. Red Bridge (East & West)

1. Continue cooperative efforts with Consumers Energy to protect bald eagle that will:
 - a. Maintain the designated buffer zones around the bald eagle nest.
 - b. Identify areas of potential nest sites and protect from development or alteration.
 - c. Where necessary, establish seasonal closures of areas and roads.
 - d. Coordinate fish management activities for Tippy Dam Pond to protect and maintain an adequate food resource for eagles.
 - e. Maintain at least 60 percent of the territory in 60 plus age class.
 - f. Identify 25 percent of the stands in the area to be retained as over-mature or old growth.

D. White River

1. Continue or develop cooperative efforts with private landowners that will:
 - a. Establish and maintain protective zones around bald eagle nests.
 - b. Avoid and discourage disturbances during critical periods.
2. Identify areas of potential nest sites and protect these from alteration or development on National Forest System lands.
3. Management for other wildlife habitats should not conflict with the management and protection of potential bald eagle habitat elements.

E. Alcona Pond

1. Maintain the bald eagle nest sites and any other potential sites that now exist in their present undisturbed condition. This would entail acquiring a conservation easement or fee title.
 - a. Where feasible, all roads and trails on these parcels would be closed and obliterated.
 - b. The only developments or alterations on these tracts that would be permitted would be those that would enhance the nesting ability of the eagles. If recreational activities became a disruption, seasonal closures may be necessary to protect the nest site.

F. Sprinkler Lake

1. Continue cooperative efforts to protect bald eagle that will:
 - a. Maintain the designated buffer zones around the bald eagle nest.
 - b. Identify areas of potential nest sites and protect from development or alteration.
 - c. Where necessary, establish seasonal closures of areas and roads.
 - d. Maintain at least 60 percent of the territory in 60 plus age class.
 - e. Identify 25 percent of the stands in the area to be retained as over-mature or old growth.

2800 MINERALS AND GEOLOGY

I. Endangered, Threatened and Sensitive Species/Wildlife

A. Kirtland's warbler (Standard unless otherwise indicated)

1. The following stipulations will be incorporated into federal oil and gas leases and recommended in state oil and gas leases on National Forest System lands and shall apply to any operation for which this lease is a part.
 - a. Kirtland's warbler essential habitat will be available for limited oil and gas development as shown in table III-5:

Table III-5. Oil and Gas Development Density.

Age of Essential Habitat	Maximum Development Density
0 to 25 years	1 surface location per 640 acres
26 to 40 years	1 surface location per 160 acres
Older than 40 years	1 surface location per 640 acres

b. Surface operation location priorities are:

1. First priority for surface operation location will be stands (or inclusions of stands) that are not biologically appropriate for the development of breeding habitat for the Kirtland's warbler.

2. Second priority for surface operation location will be stands within essential habitat that are greater than 26 years old.

3. Third priority for surface operation location will be stands within essential habitat that are 0 to 25 years old.

c. Exceptions may be granted through consultation with the Forest Service and the U.S. Fish and Wildlife Service.

2. Common variety mineral deposits will not be developed in areas of essential Kirtland's warbler habitat.

3. These conditions of approval would be attached to any permit for exploration and development.

a. No drilling, exploration, construction or maintenance involving the use of heavy equipment shall take place within one-half mile of or create noise greater than 85 decibels in occupied habitat, between May 1 and September 30.

b. In occupied habitat, proven wells can be operated between October 1 and April 30, but between May 1 and September 30 only if they are flowing or operated by a bottom-hole pump and:

1. the product is transported by buried pipeline;

2. collection and storage facilities are located off essential habitat where feasible; (Guideline)

3. noise from production operations will be less than 85 decibels at 100 feet;

4. access is limited to routine monitoring of the well.

4. In all essential habitat, oil and gas development shall be done in such a manner that the management of this habitat through the use of prescribed burning and planting is not precluded. (Guideline)

5. All access roads will be gated and locked.

6. Location of well sites, roads, facilities and pipelines will be approved by the Forest Line Officer in charge prior to construction.

7. A reclamation plan for all wells, pipelines, production facilities, and access routes must be submitted to the Forest Line Officer in charge for approval. These plans will detail the replanting and restoration of these areas. Disturbed areas will be restored after completion of drilling and/or production operations.

a. Those areas not scheduled for reforestation and all areas disturbed prior to reforestation will receive treatments to establish permanent vegetative cover. The permanent vegetative cover will consist of a mixture of native warm season grasses; such as Big Bluestem, Little Bluestem, Indian grass, and a variety of annual forbs and legumes. These will be scheduled for establishment just prior to the next growing season, generally late April, May, or early June. If an activity is completed before this timeframe, an annual cover crop with adequate soil nutrients is required.

- b. All soil disturbance actions associated with the oil and gas exploration and development activity will receive similar treatments.
 - 8. Upon the establishment of economically producible reserves, a general hydrocarbon development plan must be submitted. This plan will detail future oil and/or gas development of the newly established field. (Standard)
 - 9. Access to oil and gas development is by low standard road with minimum clearing. The access road should be obliterated upon abandonment of the site.
- B. Karner Blue Butterfly
 - 1. Federal oil and gas leases will contain a lease notice that the lands are identified as Karner blue butterfly metapopulation areas and occupancy is subject to more restrictive controls than routine areas.
 - 2. Access to oil and gas development is by low standard road with minimum clearing. These roads are gated. The access road should be obliterated upon abandonment of the site.

3400 FOREST PEST MANAGEMENT

I. In the Kirtland's Warbler Management Areas, pesticides will be used only after consultation and coordination with the U.S. Fish and Wildlife Service. (Standard)

II. Control of predators and parasites, such as cowbirds, will be completed within the scope of the Recovery Plan and coordinated through the U.S. Fish and Wildlife Service and the Kirtland's Warbler Recovery Team. (Guideline)

7700 TRANSPORTATION SYSTEM

I. Kirtland's Warbler/Bald Eagle

- A. Close roads under National Forest jurisdiction in occupied Kirtland's warbler and bald eagle habitats to public entry during the breeding and nesting seasons, where necessary.

MA 4.3- Roaded Natural Wetlands

These areas are predominately maturing lowland hardwoods and conifer types, aspen, and wetlands. Rivers, lakes and associated riparian zones are common. Management activities in these areas provide a variety of forest views and scenes in a primarily motorized recreational environment. Fish and wildlife are abundant, and efforts are made to increase and enhance various habitats. Emphasis is given to managing deer, grouse and wildlife emphasis areas. The federally listed species that potentially occur in this MA are the Indiana bat, piping plover, Karner blue butterfly, Pitcher's thistle, and bald eagle.

Desired Conditions

- 1- Human activities are evident and interaction among users is moderate.
- 2- The area will provide roads and trails appropriate for motorized and non-motorized uses. A net reduction of road miles is noticeable.
- 3- Extensive stands of softwood and hardwood species occur throughout the area and create

a natural forest appearance, with interspersed openings throughout the area. The dominant tree species are aspen, cedar, hemlock, red maple, elm, black ash, and paper birch. There are approximately 29,100 acres of designated old growth in this management area.

Goals and Objectives

- 1- Provides high amounts of dispersed recreational activities such as hunting, fishing, viewing scenery, bird watching, canoeing, with limited OHV use.
- 2- Provides low to moderate amounts of recreational facilities such as canoe landings, campgrounds and picnic areas.
- 3- Provides low volumes of timber products.
- 4- Management will strive to increase utilization of wood residues and other currently non-merchantable material, when not needed for resource concerns such as soil productivity and wildlife habitat, for fuelwood and other special forest products.
- 5- Quality sites and opportunities for intensive timber management practices will be identified commensurate with the site's ecological capabilities.
- 6- Manage permanent openings and/or grasslands to meet species viability needs. Distribution of openings will recognize the contribution of adjacent private lands.
- 7- Manage for mesic grassland habitats.
- 8- Provide opportunities for mineral exploration and development.

Standards and Guidelines most pertinent to listed species

2600 WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT MANAGEMENT

II. Endangered and Threatened Species and Their Habitat Management

A. Piping Plover (Standards unless otherwise noted)

1. Active nest sites and areas used for raising young will be protected from human disturbance and pets. Pets will be required to be on a leash between April 1 and August 31 and at anytime near an active nest.
2. The following access restrictions will apply from April 1 to August 31 and any time around active nest sites:
 - a. Except for emergency, administrative use, vehicle traffic will be prohibited along the beach. Efforts will be made to coordinate emergency, administrative use with individuals knowledgeable of nest sites.
 - b. Trail management and construction will direct the public away from active nest sites.
 - c. Pedestrians will be prohibited from leaving trails and entering nest site areas.
 - d. Kite flying will be prohibited within 650 feet of active nest site areas.
3. Signing and psychological/symbolic fencing, such as 2 strands of twine tied between posts, will be allowed to keep human activity at least 134 feet away from predator exclosures. If needed, a larger protection area may be designated. Fencing and signing will be installed using current acceptable procedures.
(Guideline)

4. Where necessary, nesting and feeding areas will be protected from predators through predator exclosures and other proven devices and methods. Exclosures will be as follows: 5 feet between the nest and the predator exclosure, and 134 feet between predator exclosure and the psychological/symbolic fencing. Construction will occur at a time that does not subject the eggs to adverse weather during absence of adults. Fencing and signing will be installed using current acceptable procedures. (Guideline)

B. Piping Plover Critical Habitat (Guideline unless otherwise indicated)

1. Human disturbance, including pets, will be kept at a low level from April 1 through July 1 by prohibiting the following:
 - a. Pets (unless on a leash).
 - b. Loud noise.
 - c. Off-Highway Vehicles.
 - d. Beach fires within 400 feet of the shoreline.
 - e. Collecting of driftwood, dunewood, root masses, and dead shrubs.
2. Prohibit sand mining and oil and gas leasing and development in critical habitat, except for reserved and outstanding mineral rights. (Standard)
3. Beach stabilization and vegetation planting for artificial dune stabilization will not be allowed if they impair natural processes. (Standard)
4. Management activities related to treatment of Lombardy poplar are prohibited between April 1 and July 1 or whenever piping plover are present. (Standard)
5. Between April 1 and July 1, prescribed burning activities will be limited to conditions when smoke will not drift into critical habitat areas or whenever piping plover are present.
6. The following apply for the protection, restoration, and maintenance of piping plover critical habitat containing primary constituent elements:
 - a. No new trail construction will occur.
 - b. Existing trails will be relocated where necessary.
 - c. Non-native woody vegetation (non-native invasive species) will be controlled.
 - d. Surveying will be conducted for the presence of active nest sites.

C. Pitcher's Thistle (Guideline unless otherwise indicated)

1. See Chapter II, 2600 for Standards and Guidelines.

IV. Wildlife Emphasis Areas (Guidelines)

B. Huron Shores

1. Identify and protect potential bald eagle nest sites.
2. Identify thermal cover and apply only those management treatments that improve and sustain cover quality.

C. Cooke Dam

1. Establish the required buffer zones around bald eagle nest(s).
2. Identify perch trees and potential nest areas and protect from development or alterations.
3. Reduce the potential of disturbance by closing trails where necessary and feasible.

D. South Branch River

1. Identify and protect potential bald eagle nest sites.
2. Maintain a low road and trail density and do not improve or develop access to the lakes within the area.
3. Identify the thermal cover areas used by deer and use only treatments that are needed to improve or sustain thermal qualities.
4. Identify those stands that are to be managed through regeneration cuts to increase and sustain winter browse conditions for deer. Such cuts should favor regeneration of short-lived types.

E. Mio Pond

1. Identify and maintain the protection zone around bald eagle nests.
2. Identify and protect potential bald eagle nest sites.

F. Jenks Lake

1. Identify potential bald eagle nest and roost sites and protect these from development and other activities.

MA 4.4- Rural

This rural condition encompasses a broad spectrum of landforms that includes sandy plains, morainal hills, and riparian areas. This condition exists where National Forest ownership is scattered and human activities have altered the landscape. Management activities provide recreational opportunities, sources of firewood close to users, and moderate to high volumes of softwood timber products. Wildlife management is coordinated with adjacent non-National Forest System land management with emphasis on deer, grouse, and wildlife management. Some small blocks will be managed to protect isolated, essential areas for endangered, threatened, or sensitive species. The federally listed species that may occur in this MA are the Indiana bat and the Karner blue butterfly.

Desired Conditions

The ownership pattern of National Forest System land within this management area is often scattered. It is often a mixture of agricultural land, private lots and wooded National Forest System land that creates a rural environment. Human activities such as vegetation management, facilities, structures, utility corridors, mineral exploration and development are evident and harmonize with the surrounding environment. Interaction between users is frequent and users are aware of services provided, such as visitor information and law enforcement. There are few opportunities to test primitive outdoor skills. The area will provide roads and trails appropriate for motorized and non-motorized uses.

- 1- The ownership pattern of National Forest System land within this management area is often scattered. It is often a mixture of agricultural land, private lots and wooded National Forest System land that creates a rural environment.
- 2- Human activities such as vegetation management, facilities, structures, utility corridors, mineral exploration and development are evident and harmonize with the surrounding environment. Interaction between users is frequent. Users are aware of services provided, such as visitor information and law enforcement. There are few opportunities to test

primitive outdoor skills. The area will provide roads and trails appropriate for motorized and non-motorized uses.

- 3- Red, white and jack pine are the dominant tree species, although aspen and other hardwoods are present. The trees within each stand are about the same age and size. Openings are interspersed throughout the area. There are approximately 6,900 acres of designated old growth in this management area.
- 4- The scattered openings on private land are agricultural fields, idle land, borrow pits and roads.
- 5- Facilities, structures, utility corridors, mineral exploration and mineral development are evident and harmonize with the surrounding environment.

Goals and Objectives

- 1- Maintain or increase wildlife habitat diversity.
- 2- Emphasize hazardous fuels treatment in wildland urban interface and intermix areas.
- 3- Provide recreational facilities for camping or picnicking.
- 4- Provide improvements for fish habitat.
- 5- Intensively manage grouse emphasis areas to provide quality grouse habitat and manage aspen intensively.
- 6- Management will strive to increase utilization of wood residues and other currently non-merchantable material, when not needed for resource concerns such as soil productivity and wildlife habitat, for fuelwood and other special forest products.
- 7- Quality sites and opportunities for intensive timber management practices will be identified commensurate with the site's ecological capabilities.
- 8- Manage permanent openings and/or grasslands to meet species viability needs. Distribution of openings will recognize the contribution of adjacent private lands.
- 9- Manage for mesic grassland habitats.
- 10- Create dry prairie habitat on Sparta soils series.
- 11- Emphasize placement of utilities corridors in this area. Corridors are common in this management area.
- 12- Acquire, create and manage shallow water-emergent wetlands.
- 13- Provide opportunities for mineral exploration and development.

Standards and Guidelines most pertinent to listed species

2600 WILDLIFE, FISH AND SENSITIVE PLANT HABITAT MANAGEMENT

I. Threatened and Endangered Species

- A. See Chapter II 2600 for Standards and Guidelines.

2800 MINERALS AND GEOLOGY

A. Karner Blue Butterfly

1. Federal oil and gas leases will contain a lease notice that the lands are identified as Karner blue butterfly metapopulation areas and occupancy is subject to more restrictive controls than routine areas. No surface occupancy or road construction will be permitted in occupied habitat. (Standard)

2. Access to oil and gas development is by low standard road with minimum clearing. These roads are gated. The access road should be obliterated upon abandonment of the site. (Guideline)

MA 5.1- Wilderness

Designated Wilderness areas could occur anywhere from morainal hills to low, wet areas. Wilderness areas probably will include a variety of habitats and landforms. The Nordhouse Dunes Wilderness is the only Congressionally designated Wilderness on the Forests. Management activities of Congressionally designated Wilderness provide for primitive or semiprimitive, nonmotorized recreational opportunities in a natural environment emphasizing solitude. Management activities of Congressionally designated Wilderness provide for the protection and enhancement of wilderness characteristics and values. Primitive or semiprimitive, non-mechanized recreational opportunities occur in a natural environment emphasizing solitude. Recreational opportunities include backpacking, hiking, camping, canoeing, hunting, fishing, cross-country skiing, snowshoeing and other nonmotorized activities.

The listed species that potentially occur in this MA are the Indiana bat, piping plover, and the Pitcher's thistle.

Desired Conditions

- 1- These areas have a natural appearance with old growth and large trees dominating the forested stands. Timber management activities will not occur in these areas and no developed facilities or services will be provided.
- 2- Little evidence of human presence will be apparent, and interaction between users will be infrequent. Nonmotorized trails access Wilderness areas. There will be no open roads within the Wilderness area. Hunting, fishing, primitive camping and other activities may occur throughout the area. Recreation experiences here are quiet, secluded, and occur in a natural forest environment.
- 3- Surface and subsurface mineral rights generally will be in public ownership to adequately coordinate management.
- 4-

Goals and Objectives

- 1- Provides habitat for wildlife species that avoid human activities.
- 2- Allow natural ecological succession to operate to the extent feasible to promote, perpetuate and restore the wilderness character of the land - 36 CFR 293.2(a).
- 3- Provide a mixture of primitive and semiprimitive, non-mechanized recreational opportunities to meet identified needs and demands.
- 4- Trails will be designed for the wilderness experience.
- 5- Provide for the special needs of wildlife species requiring isolation consistent with the Act establishing the Wilderness
- 6- Use Minimum Impact Suppression Tactic Guidelines.
- 7- Surface and subsurface ownership, National Forest System or other government entity, is desirable.
- 8- Emphasize "no trace" camping.

Standards and Guidelines most pertinent to listed species

2600 WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT MANAGEMENT

I. Endangered and Threatened Species

A. Piping Plover (Standards unless otherwise noted)

1. Active nest sites and areas used for raising young will be protected from human disturbance and pets. Pets will be required to be on a leash between April 1 and August 31 and at anytime near an active nest.
2. The following access restrictions will apply from April 1 to August 31 and any time around active nest sites:
 - a. Except for emergency, administrative use, vehicle traffic will be prohibited along the beach. Efforts will be made to coordinate emergency, administrative use with individuals knowledgeable of nest sites.
 - b. Trail management and construction will direct the public away from active nest sites.
 - c. Pedestrians will be prohibited from leaving trails and entering nest site areas.
 - d. Kite flying will be prohibited within 650 feet of active nest site areas.
3. Signing and psychological/symbolic fencing, such as 2 strands of twine tied between posts, will be allowed to keep human activity at least 134 feet away from predator exclosures. If needed, a larger protection area may be designated. Fencing and signing will be installed using current acceptable procedures. (Guideline)
4. Where necessary, nesting and feeding areas will be protected from predators through predator exclosures and other proven devices and methods. Exclosures will be as follows: 5 feet between the nest and the predator exclosure, and 134 feet between predator exclosure and the psychological/symbolic fencing. Construction will occur at a time that does not subject the eggs to adverse weather during absence of adults. Fencing and signing will be installed using current acceptable procedures. (Guideline)

B. Piping Plover Critical Habitat (Guideline unless otherwise indicated)

1. Human disturbance, including pets, will be kept at a low level from April 1 through July 1 by prohibiting the following:
 - a. Pets (unless on a leash).
 - b. Loud noise.
2. Beach stabilization and vegetation planting for artificial dune stabilization will not be allowed if they impair natural processes. (Standard)
3. Management activities related to treatment of Lombardy poplar are prohibited between April 1 and July 1 or whenever piping plover are present. (Standard)
4. Between April 1 and July 1, prescribed burning activities will be limited to conditions when smoke will not drift into critical habitat areas or whenever piping plover are present.
5. The following apply for the protection, restoration, and maintenance of piping plover critical habitat containing primary constituent elements:
 - a. No new trail construction will occur.

- b. Existing trails will be relocated where necessary.
- c. Non-native woody vegetation (non-native invasive species) will be controlled.
- d. Surveying will be conducted for the presence of active nest sites.

C. Pitcher's Thistle (Guideline)

- 1. Herbicide use will occur only when other methods of control for specific non-native invasive plant species are ineffective.

MA 6.1- Semiprimitive Nonmotorized areas

This management area occurs throughout the Forests on well-drained, sandy plains, low, sandy hills, morainal hills and plains, and low, wet areas. Rivers, lakes, and their associated riparian zones also are found within this management area. Management activities in these areas provide for semiprimitive, nonmotorized recreational experiences and will reduce life-threatening and property-damaging wildfire potential. Areas support a wide variety of fish and wildlife. Management enhances and improves habitats for species which avoid human activity. The federally listed species that may occur within this MA are the Ibat, Karner blue butterfly, and bald eagle.

Desired Conditions

- 1- The MA is characterized by a predominantly natural or natural-appearing environment. Concentration and interaction between users is low, but there is often evidence of other users. The areas are managed in such a way that on-site controls and restrictions may be present, but are subtle.
- 2- Nonmotorized use is emphasized. Closed roads may be evident and some may be utilized as trails. Users are aware of the services provided, such as visitor information, and restrictions and controls are evident. Some roads are present but gated to provide access only for administrative or other permitted purposes. Improvements on these roads are infrequent and maintained to minimal standards necessary for health and safety needs. Other public agency roads may be present.
- 3- Dominant forest types are variable depending on the area and will range from northern hardwoods on morainal hills and plains to aspen, oaks, and red and white pines on dry sandy plains. Low, wet areas will be characterized by aspen, black ash, cedar, fir and hemlock. Stand distribution by age and size, across the landscape, is natural in appearance and dominated by old-growth characteristics. There are approximately 46,800 acres of designated old growth in this management area.
- 4- Federal or state ownership of surface and subsurface is desired.

Goals and Objectives

- 1- Provides visual variety by providing vegetative diversity.
- 2- Provide for semiprimitive, nonmotorized recreational experiences.
- 3- Provides a variety of fish and wildlife habitats for species which avoid human activity.
- 4- Produces low to moderate volumes of forest products.
- 5- Provides habitat suitable for species requiring an old-growth environment.

- 6- Allows facility development to separate competing uses.
- 7- Provides for recreational activities such as hunting, fishing, viewing scenery, and water-based recreational opportunities.
- 8- Management will strive to increase utilization of wood residues and other currently non-merchantable material, when not needed for resource concerns such as soil productivity and wildlife habitat.
- 9- Quality sites and opportunities for intensive timber management practices will be identified commensurate with the site's ecological capabilities.
- 10- Manage permanent openings and/or grasslands to meet species viability needs. Distribution of openings will recognize the contribution of adjacent private lands.
- 11- The first land acquisition priority is to acquire private inholdings.
- 12- Subsurface Ownership: Acquiring ownership of severed mineral rights is a high priority.
- 13- Provide mineral development opportunities at a limited density.

Standards and Guidelines most pertinent to listed species

2300 RECREATION, WILDERNESS, AND RELATED RESOURCE MANAGEMENT

II. Special Areas

A. Semiprimitive Nonmotorized

11. White River (Standards)

- a. Camping areas and sites will be designated. Sites and areas will avoid Karner blue butterfly habitat.
- d. Trail locations will avoid concentrated areas of wild lupine and other nectar plants utilized by the Karner blue butterfly and other associated sensitive species.

2600 WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT MANAGEMENT

III. Semiprimitive, Nonmotorized Areas

C. White River

- 1. Vegetative management will follow the Karner blue butterfly habitat management strategy. (Guideline)

IV. Wildlife Emphasis Areas

B. White River (Guidelines)

- 1. Continue or develop cooperative efforts with private landowners that will:
 - a. Establish and maintain protective zones around bald eagle nests.
 - b. Avoid and discourage disturbances during critical periods.
- 2. Identify areas of potential nest sites and protect these from alteration or development on National Forest System lands and private lands where possible.
- 3. Management for other wildlife habitats should not conflict with the management and protection of potential bald eagle habitat elements.

2800 MINERALS AND GEOLOGY

I. Endangered and Threatened Species/Wildlife

A. Karner Blue Butterfly

1. Federal oil and gas leases will contain a lease notice that the lands are identified as Karner blue butterfly metapopulation areas and occupancy is subject to more restrictive controls than routine areas. No surface occupancy or road construction will be permitted in occupied habitat. (Standard)
2. Access to oil and gas development is by low standard road with minimum clearing. These roads are gated. The access road should be obliterated upon abandonment of the site. (Guideline)

MA 6.2- Semiprimitive Motorized Areas

This management area occurs throughout the Manistee National Forest on well-drained, sandy plains, low, sandy hills, morainal hills and plains, and low, wet areas. Rivers, lakes, and their associated riparian zones also are found within this management area. Management activities provide for semiprimitive, motorized recreational experiences. These areas provide high visual diversity, enhance and increase wildlife habitats, will reduce damaging wildfire potential, and provide moderate amounts of quality timber products from appropriate areas. The listed species that may occur in this MA are the Indiana bat, and Karner blue butterfly.

Desired Conditions

- 1- The desired future condition of these management areas will be characterized by a predominantly natural or natural-appearing environment. Human activities are evident but user interaction is infrequent. Users may be aware of controls, restrictions and services provided. Visitor services such as informational signs and orientation are provided.
- 2- Facilities, utility corridors, and mineral exploration usually are not evident unless viewed on-site. Low use roads are closed but evident. Some roads are converted to Off-Highway Vehicle trails. Roads needed for administrative purposes are gated. Other public agency roads may be present. Improvements on these roads are infrequent, and roads are maintained to minimal standards necessary for health and safety needs.
- 3- Dominant forest types are variable depending on the area and will range from northern hardwoods on morainal hills and plains to aspen, oaks, and red and white pines on dry sandy plains. Low, wet areas will be characterized by aspen, black ash, cedar, fir and hemlock. Stand distribution by age and size, across the landscape, is natural in appearance and dominated by old-growth characteristics. There are approximately 11,000 acres of designated old growth in this management area.
- 4- Low, wet areas are key habitats for wildlife species. They provide thermal cover for deer and habitat for fish and water-related wildlife species.
- 5- Federal or state ownership of all surface and subsurface is desirable.

Goals and Objectives

- 1- Provide high visual variety by providing vegetative diversity.

- 2- Provide low to moderate volumes of forest products.
- 3- Develop recreation facilities to separate competing users.
- 4- Provide roads and trails for a semiprimitive, motorized experience.
- 5- Provide habitat suitable for species requiring an old-growth environment.
- 6- Provide high amounts of dispersed recreational activities such as hunting, fishing, viewing scenery, bird watching and canoeing.
- 7- Provide low to moderate amounts of developed recreational facilities, such as campgrounds and picnic areas.
- 8- Designated areas, roads and trails may be limited to specific kinds of uses.
- 9- Management will strive to increase utilization of wood residues and other currently non-merchantable material, when not needed for resource concerns such as soil productivity and wildlife habitat, for fuelwood and other special forest products.
- 10- Manage permanent openings and/or grasslands to meet species viability needs. Distribution of openings will recognize the contribution of adjacent private lands.
- 11- Federal or state ownership of surface and subsurface is desirable.
- 12- Provide opportunities for mineral exploration and development on a limited density.

Standards and Guidelines most pertinent to listed species

No specific MA standards and guidelines. Refer to Forest-wide standards and guidelines.

MA 8.1- Wild and Scenic Rivers

The Forest has 4 Congressionally designated Wild and Scenic Rivers: 1) Pere Marquette National Scenic River, 2) Pine National Scenic River, 3) Au Sable National Scenic River, and 4) Manistee National Recreation River and Bear Creek National Scenic River. Management of the Congressionally-designated wild and scenic river corridors will protect unique areas that have outstandingly remarkable values such as scientific, biological, geological, historical or recreational characteristics of local, regional or national significance. The listed species that may occur in this MA are the Indiana bat, Kirtland's warbler, and bald eagle.

Desired Conditions

- 1- Management direction follows approved management plans for designated Wild and Scenic Rivers protecting the unique features of the rivers.
- 2- Dominant forest types are variable depending on the area and will range from northern hardwoods on morainal hills and plains to aspen, oaks, and red and white pines on dry sandy plains. Low, wet areas will be characterized by aspen, black ash, cedar, fir and hemlock. Stand distribution by age and size, across the landscape, is natural in appearance and dominated by old growth characteristics. There are approximately 17,100 acres of designated old growth in this management area.
- 3- Federal or state ownership of all surface and subsurface mineral rights is desirable.

Goals and Objectives

- 1- Maintain the outstandingly remarkable values of each river for which they were designated under the Wild and Scenic Rivers Act.
- 2- Management direction is established by each river's management plan.
- 3- Manage Kirtland's warbler essential habitat consistent with the Kirtland's Warbler Recovery Plan.

Standards and Guidelines most pertinent to listed species

No specific MA standards and guidelines. Refer to Forest-wide standards and guidelines.

MA 8.2- Research Natural Areas

The Forest has 3 designated Research Natural Areas (RNA): 1) Hayes Tower, 2) Newaygo Prairies, including West Tract Prairie and Finger Prairie, and 3) Nordhouse Dunes Research Natural Area. Management of designated Research Natural Areas will protect unique areas that have scientific, biological, geological or historical characteristics of local, regional or national significance. The listed species that may occur in this MA are the Indiana bat, Karner blue butterfly, piping plover, and Pitcher's thistle.

Desired Conditions

- 1- Management direction will follow approved establishment records for designated Research Natural Areas protecting the unique features of the areas.
- 2- Federal or state ownership of all lands and surface and subsurface is desirable.
- 3- There are approximately 400 acres of designated old growth in this management area.

Goals and Objectives

- 1- Maintain the characteristics of each Research Natural Area for which they were designated.
- 2- Management direction is provided in each area's establishment record.
- 3- Recreation in the area such as hiking, hunting, camping and fishing will not be encouraged.
- 4- Research and monitoring that aids the protection and management of populations of endangered, threatened, sensitive or rare species will be encouraged.
- 5- The Huron-Manistee National Forests and North Central Research Station shall encourage appropriate use of Research Natural Areas by scientists, educators and managers

Standards and Guidelines most pertinent to listed species

2600 WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT MANAGEMENT

II. Endangered and Threatened Species

- A. Reintroduction of extirpated species is permitted. (Guideline)
- B. If endangered or threatened species are found, they will be protected and recovery plans will be implemented. Consultation will be made with the U. S. Fish and Wildlife

Service and the Station Director regarding the appropriate course of action to take.
(Standard)

C. Piping Plover (Standards unless otherwise noted)

1. Active nest sites and areas used for raising young will be protected from human disturbance and pets. Pets will be required to be on a leash between April 1 and August 31 and at anytime near an active nest.
2. The following access restrictions will apply from April 1 to August 31 and any time around active nest sites:
 - a. Except for emergency, administrative use, vehicle traffic will be prohibited along the beach. Efforts will be made to coordinate emergency, administrative use with individuals knowledgeable of nest sites.
 - b. Trail management and construction will direct the public away from active nest sites.
 - c. Pedestrians will be prohibited from leaving trails and entering nest site areas.
 - d. Kite flying will be prohibited within 650 feet of active nest site areas.
3. Signing and symbolic fencing, such as 2 strands of twine tied between posts, will be allowed to keep human activity at least 134 feet away from predator exclosures. If needed, a larger protection area may be designated. Fencing and signing will be installed using current acceptable procedures. (Guideline)
4. Where necessary, nesting and feeding areas will be protected from predators through predator exclosures and other proven devices and methods. Exclosures will be as follows: 5 feet between the nest and the predator exclosure, and 134 feet between predator exclosure and the psychological/symbolic fencing. Construction will occur at a time that does not subject the eggs to adverse weather during absence of adults. Fencing and signing will be installed using current acceptable procedures. (Guideline)

B. Piping Plover Critical Habitat (Guideline unless otherwise indicated)

1. Human disturbance, including pets, will be kept at a low level from April 1 through July 1 by prohibiting the following:
 - a. Pets (unless on a leash).
 - b. Loud noise.
 - c. Off-Highway Vehicles.
 - d. Beach fires within 400 feet of the shoreline.
 - e. Collecting of driftwood, dunewood, root masses and dead shrubs.
2. Prohibit sand mining and oil and gas leasing and development in critical habitat, except for reserved and outstanding mineral rights. (Standard)
3. Beach stabilization and vegetation planting for artificial dune stabilization will not be allowed if they impair natural processes. (Standard)
4. Management activities related to treatment of Lombardy poplar are prohibited between April 1 and July 1 or whenever piping plover are present. (Standard)
5. Between April 1 and July 1, prescribed burning activities will be limited to conditions when smoke will not drift into critical habitat areas or whenever piping plover are present.

6. The following apply for the protection, restoration, and maintenance of piping plover critical habitat containing primary constituent elements:

- a. No new trail construction will occur.
- b. Existing trails will be relocated where necessary.
- c. Non-native woody vegetation (non-native invasive species) will be controlled.
- d. Surveying will be conducted for the presence of active nest sites.

C. Pitcher's Thistle (Guideline)

1. See Chapter II, 2600 for Standards and Guidelines.

MA 8.3- Experimental Forests

The Forest has 3 designated Experimental Forests: the Udell, Newaygo, and Pine River Experimental Forests. Management of designated experimental forests provides a land base for research activities. The listed species that may occur in this MA is the Karner blue butterfly.

Desired Conditions

- 1- Management direction for experimental forests is established by the North Central Research Station, St. Paul, MN.
- 2- There are approximately 2,200 acres of designated old growth in this management area.

Goals and Objectives

- 1- The experimental forests will be managed as a roaded natural setting.
- 2- The Huron-Manistee National Forests and North Central Research Station shall encourage appropriate use of experimental forests by scientists, educators, and managers.
- 3- Provide a variety of management activities so that research opportunities exist to evaluate the effects of management practices.

Standards and Guidelines most pertinent to listed species

No specific MA standards and guidelines. Refer to Forest-wide standards and guidelines.

MA 9.1- Candidate Research Natural Areas

Management of candidate Research Natural Areas (cRNA) will protect unique areas that have scientific, biological, geological or historical characteristics of local, regional or national significance. These are lands in holding for candidate Research Natural Areas until establishment record and environmental documentation is completed for designation. Management activities provide for research natural area attributes and values. The Forest has proposed or designated 18 cRNAs across the Forest, amounting to approximately 1% of the total land base. The listed species that may occur in this MA are the Indiana bat and the Karner blue butterfly.

Desired Conditions

- 1- Candidate Research Natural Areas are managed the same as Research Natural Areas.
- 2- There are approximately 5,600 acres of designated old growth in this management area.

Goals and Objectives

- 1- Maintain the characteristics of each candidate Research Natural Area for which they were identified.
- 2- Recreation in the area such as hiking, hunting, camping, and fishing will not be encouraged.
- 3- Research and monitoring that aids the protection and management of populations of endangered, threatened, sensitive or rare species will be encouraged.
- 4- Develop an establishment plan.

Standards and Guidelines most pertinent to listed species

No specific MA standards and guidelines. Refer to Forest-wide standards and guidelines.

MA 9.2- Study Wild and Scenic Rivers

Management of study Wild and Scenic River corridors will protect unique areas that have scientific, biological, geological, historical or recreational characteristics of local, regional or national significance. These are Lands in holding until studies and environmental documentation for designation are completed. Management activities provide for Wild and Scenic River attributes and values. The Forest has 5 study Wild and Scenic River corridors: 1) White River, 2) Little Manistee River, 3) Muskegon River, 4) Little Muskegon River, 5) Pine River Addition. The listed species that may occur within this MA are the Indiana bat , Karner blue butterfly, and bald eagle.

Desired Conditions

- I. Complete the evaluation of the study rivers (White and Little Manistee), suitability evaluation (Muskegon River, Little Muskegon River and Pine River Addition).
- II. There are approximately 7,600 acres of designated old growth in this management area.

Goals and Objectives

- 1- Maintain the unique characteristics of each river for which they were identified.
- 2- Complete the evaluation of these rivers.
- 3- Manage the Croton Prairie Wildlife Emphasis Area with the following objectives:
 - a. Identify and manage habitats for other wildlife (for example, winter deer range) in these areas on National Forest lands so long as they do not conflict with the management and protection of potential eagle habitat elements.
 - b. Develop cooperative efforts with private landowners that will encourage landowners to request the advice of State and Federal biologists on any activities that may affect the nesting territory.

Standards and Guidelines most pertinent to listed species

2600 WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT MANAGEMENT

I. Wildlife Emphasis Areas

A. Croton Prairie (Guidelines)

1. Establish and maintain protective buffer zones around bald eagle nests.
2. Avoid and discourage disturbances during critical periods.
3. Identify areas of potential nest sites and protect these from alteration or development on National Forest System lands and private lands, where possible.

4. Monitoring and Evaluation

The Revised Forest Plan also includes broad, strategic guidance for monitoring and evaluation in Chapter 4 (Table 10). The Forest’s monitoring framework must: 1) meet the legal requirements of the planning regulations, 2) be consistent with corporate data standards and protocols, and 3) be developed by an interdisciplinary team that addresses the ecological, social and economic dimensions of forest management in an integrated manner. To meet these objectives, the monitoring framework proposed by the Forest has four components:

Table 10. Monitoring Framework.

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

The Forest will produce an annual monitoring and evaluation report to track progress towards the implementation of revised Forest Plan decisions and the effectiveness of specific management

practices. The focus of the evaluation is in providing short- and long-term guidance to ongoing management. The monitoring and evaluation report should include components such as:

- 1) Forest accomplishments toward desired conditions and outputs of goods and services.
- 2) Forest Plan amendment status.
- 3) Status of other agency/institution cooperative monitoring.
- 4) Summary of available information on management indicator species or comparable species.
- 5) Summary of large-scale or significant projects or programs (such as storm recovery).
- 6) Update of research needs.
- 7) Public participation/disclosure plan.

Required and management direction monitoring are outlined in the following matrix (Table 11). Only those monitoring points that specifically reference threatened and endangered species are included here.

Table 11. Monitoring Matrix.

Resource Area	Monitoring Question(s)	Driver: Applicable Code of Federal Regulations (CFR)	Measurement Frequency	Evaluation/ Reporting Frequency	Precision and Reliability Class*
Required Monitoring Items (Category 1)					
Wildlife: Management Indicator Species	What are the population trends of management indicator species? What are the relationships of the population trends to habitat changes?	36 CFR 219.19(a)(6). Population trends of the management indicator species will be monitored and relationships to habitat changes determined. This monitoring will be done in cooperation with state fish and wildlife agencies, to the extent practical.	Annual	1-5 years	A and B
All	What are the identified research needs?	36 CFR 219.28 Research needs for management of the National Forest System shall be identified during planning and periodically reviewed during evaluation of implemented plans.	Annual	5 years	A and B
Desired Condition and Objective Monitoring Items (Categories 2, 3 and 4)					
All	What Standards, Guidelines, or Objectives are not being met?	36 CFR 219.12 (k). At intervals established in the plan, implementation shall be evaluated on a sample basis to determine how well objectives have been met and how closely management standards and guidelines have been	Annual	Annual	A and B

Resource Area	Monitoring Question(s)	Driver: Applicable Code of Federal Regulations (CFR)	Measurement Frequency	Evaluation/ Reporting Frequency	Precision and Reliability Class*
		applied. Based upon this evaluation, the interdisciplinary team shall recommend to the Forest Supervisor such changes in management direction, revision, or amendments to the Forest Plan as are deemed necessary. Forests' Land and Resource Management Plan Standards, Guidelines and Objectives			
Wildlife and Vegetation Management	What are the amounts, distribution, and types of available habitats?	Wildlife and Rare plants: Provide for the sustainability of terrestrial and aquatic ecosystems at multiple scales	Annual	1-5 years	A and B
Wildlife and Vegetation Management	Are minimum viable populations of appropriate native and desirable non-native species being maintained within the planning area?	Wildlife and Rare plants: Maintain minimum viable populations of appropriate native and desirable non-native species within the planning area.	Annual	1-5 years	A and B

* Two categories of precision and reliability are used: Class A: Methods appropriate for modeling or quantitative measurement. Results have a high degree of repeatability, reliability, accuracy and precision. Class B: Methods based on project records, personal communications, ocular estimates, paced transects, informal visitor surveys and similar types of assessments. The degree of repeatability, reliability, accuracy and precision are not as high as Class A methods, but they still provide valuable information.

The proposed Plan (as described in the BA) also includes measures monitoring for listed species, as follows:

Indiana bat

- Monitor the presence of Indiana bats at the Tippy Dam hibernaculum during fall swarming and winter surveys in cooperation with Consumers Energy on a five-year frequency interval.
- Monitor presence of Indiana bats during the summer period on the Manistee National Forest suitable habitat area using Service-approved protocols on a three-year frequency interval.
- As appropriate, conduct periodic Indiana bat studies such as: summer surveys in the western half of the Manistee National Forest and autumn swarming/spring staging surveys in the area near Tippy Dam.

Bald eagle

Monitoring and reporting frequency for bald eagle populations would be done annually for the life of the Forest Plan, with a high degree of precision and reliability. We anticipate continuing to collaborate with the Michigan DNR and Consumers. If and when the bald eagle is delisted, collaborative monitoring with our partners would continue.

More specific technical guidance on monitoring methods will be outlined in the Monitoring Guide. This guide will describe how to accomplish the monitoring prescribed in the Forest Plan. It will provide the specific methods, protocols and analytical procedures. We anticipate collaborating with Michigan DNR, Consumers, tribes, Fish and Wildlife Service, and the public to ensure appropriate monitoring.

Kirtland's warbler

- Population trends and their relationship to habitat changes will be monitored and evaluated on an annual basis.

Piping plover and Designated critical habitat

- Monitor for piping plovers and nests in critical habitat twice weekly during the nesting season, from April 1 to August 31. Determine the number of active nest sites and success ratio of nests and young fledged. Monitoring for presence and nesting activity will occur on average two times per week during the nesting period. If no piping plover nesting is observed by July 1, monitoring frequency may be decreased to once per week. If no nesting behavior is observed through July, monitoring frequency may be further decreased until the end of the nesting season. All observations of piping plover and nests will be reported to the USFWS East Lansing Field Office.
- Monitor active nest sites daily, evaluate the effectiveness of protective measures, document the cause of nest failures using standard protocols, and post-fledging habitat conditions and human disturbance effects.
- Monitor Primary Constituent Elements in critical habitat.
- Collect abandoned eggs or chicks per current USFWS protocols.
- Assist in actions identified in the Piping Plover Recovery Plan, such as bird banding.
- Consider, when appropriate, additional efforts to manage potential predator populations that may threaten nesting piping plovers and their young.
- Attend the annual USFWS piping plover planning and training sessions.
- The effectiveness of posted areas where pets are required to be on leashes will be actively monitored. The monitoring information will be used to determine and document the levels of compliance and non-compliance with leash-requirement postings and evaluate the overall effectiveness of leash-requirement postings. The monitoring information (non-compliance i.e., pets observed off-leash) will be coordinated with the USFWS to determine if additional actions are required
- Implement recovery measures as appropriate: inventories, management plans, information and education, restoration, research.

Karner blue butterfly

- Annual sampling each of the four metapopulations during the first or second flight period to determine population size. Preference should be given to the second flight period because this is when the greatest number of butterflies would be present.
- Determining and tracking the amount and condition of habitat maintained and restored annually.
- Identifying threats and disturbance factors affecting metapopulations and habitat a minimum of every three years.
- Assessing the connectivity of subpopulations every three years to confirm that subpopulations remain connected.
- Implement recovery measures: inventories, management plans, information and education, restoration, and studies as appropriate.

Pitcher's thistle

- Monitor Pitcher's thistle populations on a 5 year interval.
- Implement recovery measures: inventories, management plans, information and education, restoration, and studies, as appropriate.

We believe that this monitoring, along with any effectiveness or compliance monitoring associated with future consultations under these Forest Plans, should allow the Service and Forests to assess consistency with the Forest Plans and with this biological opinion. Unanticipated effects on listed species would likely be detected, and the success of conservation and recovery efforts could be evaluated and adjusted as needed.

SPECIES/CRITICAL HABITAT THAT MAY BE AFFECTED BY THE PROPOSED ACTION

The Forest has determined that the proposed action considered in this biological opinion is likely to adversely affect the piping plover, Indiana bat, Karner blue butterfly, Pitcher's thistle, bald eagle, and Kirtland's warbler. The Forest has determined that the proposed action is not likely to adversely affect piping plover critical habitat.

Great Lakes Piping Plover and Critical Habitat

The Forest has determined that the action being considered in this biological opinion is likely to adversely affect the Great Lakes piping plover, but is not likely to adversely affect piping plover critical habitat. The following section discusses the status of the piping plover and critical habitat, both on a range-wide basis and within the action area, and our evaluation of the determination for this species.

Status of the species and critical habitat

This section presents the biological or ecological information relevant to formulating the biological opinion. The purpose is to provide the appropriate information on the species life history, its habitat and its range-wide distribution and conservation status for analyses in later sections. This section also documents the effects of all past human and natural activities or events that have led to the current status of the species.

Species Description

The piping plover, named for its melodic call, is a small North American shorebird approximately 6.7 in (17 cm) in length (Palmer 1967) that weighs 1.4-2.3 oz (40-65 g) and has a wing span measuring about 15 in (38 cm) (Haig 1992). Light sand-colored upper plumage and white undersides blend in well with the piping plover's principal beach habitats. During the breeding season, the legs and bill are bright orange and the bill has a black tip. Other distinctive markings include a single black band across the upper breast and a smaller black band across the forehead. In adult females, the breast band is often thin or incomplete, and plumage is frequently duller than in adult males (Wilcox 1959; Haig 1992). During winter, the legs pale, the bill turns black, and darker markings are lost. Chicks have speckled gray, buff, brown, and white down. The coloration of fledged young resembles that of adults in winter. Juveniles acquire adult plumage the spring after they fledge (Prater et al. 1977).

Life History

Piping plovers return to their breeding grounds in late April to early May, and most nests are initiated by mid- to late May (Pike 1985). Courtship behavior includes aerial displays, digging of several nest scrapes, and a ritualized stone-tossing display (Cairns 1977; 1982; Haig 1992). Piping plover nests are shallow scrapes in the sand that are lined with pebbles, shells, and driftwood. Both adults actively defend nest territories and share incubation duties that last 25 to 31 days (Wilcox 1959; Cairns 1977; Prindiville 1986; Wiens 1986; Haig and Oring 1988). Females lay an egg approximately every other day; clutches are complete at three or four eggs.

At Great Lakes nesting sites, eggs hatch from late May to late July (Lambert and Ratcliff 1981; Pike 1985). Precocial chicks usually hatch within one half to one day of each other and are able to feed themselves within a few hours, following their parents and plucking invertebrates, including insects, spiders, marine worms, crustaceans, and mollusks, from the sand (Haig 1992). Most foraging is diurnal. Piping plovers utilize numerous areas within breeding and wintering habitats for foraging, including wet sand in the wash zone, intertidal ocean beach, wrack lines, washover passes, mud, sand and algal flats, and shorelines of streams, ephemeral ponds, lagoons, and salt marshes (Powell 1991; Hoopes et al. 1992; Loegering 1992; Zonick et al. 1998). Several studies on the Atlantic Coast indicate that foraging habitat and food resources ultimately affect piping plover survival (Loegering and Fraser 1995; Goldin and Regosin 1998; Elias et al. 2000).

Piping plover eggs and young are so well camouflaged that they may go unnoticed. When predators or intruders are near, the young remain motionless while the parents attempt to attract

the attention of the intruders to themselves, often by feigning a broken wing or false brooding. Chicks cannot fly until between 21 and 30 days after hatching, making them vulnerable to predators. Piping plovers depart their Great Lakes breeding areas from mid-July to early September (Pike 1985; Wemmer 2000).

The wintering ranges of the three breeding populations of the piping plover overlap and extend from Virginia to Florida on the Atlantic Coast and from the Florida Gulf Coast west to Texas and into Mexico, the West Indies and the Bahamas (Haig 1992). The amount of population mixing that occurs on the wintering grounds is not known. Great Lakes piping plovers winter primarily on the Atlantic and Gulf Coasts from Virginia to Texas, although some migrate as far south as Mexico and the Bahamas.

Recent data from piping plovers banded in Michigan suggest an adult survival rate of approximately 70 percent, a similar level to that reported for other populations (Wemmer and Cuthbert 1999; Wemmer 2000). Survival of fledglings in the Great Lakes to first breeding (30 percent) falls between rates reported for populations in the Great Plains and Atlantic Coast.

In Michigan, adults returned to beaches where they nested previously approximately 65 percent of the time. Adult fidelity to breeding areas in other piping plover populations range from 24 percent to 69 percent (Haig and Oring 1988). Because adults use numerous beaches throughout their lifetimes and many young breeders nest distant from natal areas, preservation of historic and less frequently used areas in addition to traditional breeding sites remains important for population persistence.

Threats

Several factors threaten the continued existence of piping plovers on Great Lakes beaches, including habitat destruction and modification, predation, inadequate regulatory mechanisms, disturbance by humans and pets, small population size, and contaminants. Shoreline development and increased recreational use of beaches on the breeding and wintering grounds is responsible for habitat loss. Vehicles have crushed eggs and killed chicks and adults. Other motorized activities, such as boating, jet-skiing, or flying aircraft may also be a disturbance if they occur too close to beaches that support piping plovers. Beach-walking, bike riding, kite flying, fireworks, bonfires, OHVs, horseback riding, kayaking, windsurfing, camping and close-up photography are among many non-motorized activities that disturb piping plovers and disrupt normal behavior patterns. Disturbance by humans and pets may deter plovers from using nesting or foraging habitat, cause chicks to become separated from their parents, or cause parents to desert their nests, leaving eggs or chicks exposed to summer sun and predators. Dogs frequently chase and attempt to capture adults and chicks.

Human developments near beaches attract increased numbers of predators such as skunks and raccoons (USFWS 1985a). Predation accounted for approximately 14.5 percent of nest failures between 1981 and 1999 and predators are suspected in the majority of disappearances of unfledged chicks (USFWS 2003A). Actual identified and potential predators include herring gull, ring-billed gull, merlin (*Falco columbarius*), peregrine falcon (*F. peregrinus*), great horned owl (*Bubo virginianus*), snowy owl (*Nyctea scandiaca*), American crow, common raven, red fox,

coyote, raccoon (*Procyon lotor*), striped skunk, domestic cat (*Felis domestica*), and dog (*Canis familiaris*) (USFWS 2003A, Heramb 2004).

By virtue of its small size and geographic isolation, the Great Lakes piping plover population is at greater risk of extinction than larger widespread populations because it is more likely to be destroyed by random environmental events. Inbreeding depression and loss of genetic diversity through a population bottleneck are potential concerns.

Piping plovers may accumulate contaminants from point sources and non-point sources at breeding, migratory stopover, and wintering sites. Oil spills represent an important concern for Great Lakes piping plovers wintering on both the Atlantic and Gulf Coasts and to piping plovers migrating and breeding along Great Lakes waterways.

Status and Distribution

The piping plover was listed under the Act on January 10, 1986 (50 FR 50726). The piping plover breeds only in North America in three geographic regions: the Atlantic Coast, the Great Lakes, and the Northern Great Plains. These three breeding populations were listed separately in the final rule; the Atlantic and Northern Great Plains populations are classified as threatened and the Great Lakes population as endangered. Plovers on migration and in wintering areas are considered threatened under the Act.

Critical habitat for the breeding population of the Great Lakes piping plover was designated on May 7, 2001 (USFWS 2001a). A total of 35 units, encompassing 325 km (201 mi) of shoreline in 26 counties in eight states (Minnesota, Michigan, Wisconsin, Illinois, Indiana, Ohio, Pennsylvania, and New York) were included in the designation. The greatest number of critical habitat units (23) occurs in Michigan with a total shoreline length of 139 mi (224 km). The remaining units cover approximately 62 mi (101 km) of shoreline in the other seven states.

Within the geographic areas designated, only those areas that contain the Primary Constituent Elements (PCEs), as defined by 50 CFR 424.12(b), are considered as critical habitat. The PCEs for the Great Lakes breeding population of the piping plover are defined as island and mainland shorelines that support open, sparsely vegetated, sandy habitats, such as sand spits or sand beaches, that are associated with wide, unforested systems of dunes and inter-dune wetlands. Per the rule, suitable sites must have at least 0.12 mi (0.2 km) of gently sloping, sparsely vegetated (< 50 percent herbaceous and woody cover) sand beach with a total beach area of at least 5 ac (2 ha). Within these size sites, the habitat must be at least 164 ft (50 m) in length where beach width is greater than 23 ft (7 m); there is protective cover for chicks; and the distance to the treeline from the normal high water line is more than 164 ft (50 m). The beach width may be narrower than 23 ft (7 m) if areas of sand and cobble of at least 23 ft (7 m) exist between the dune and treeline. Sites must also have a low level of disturbance from human activities and from domestic animals.

The final rule designating critical habitat for the wintering grounds was published on July 10, 2001 (USFWS 2001b). A total of 142 units, encompassing 1798.3 mi (2,891.7 km) of shoreline and approximately 165,211 ac (66,881 ha) in eight states (North Carolina, South Carolina,

Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas) were included in the designation. The greatest number of critical habitat units occurs in Florida (34 units) and Texas (37 units). Critical habitat units designated in Florida, Texas and Louisiana encompass 1351 mi (2,172 km) of shoreline. The PCEs for the wintering population of the piping plover are defined as geologically dynamic coastal areas that support intertidal beaches and flats (between annual low tide and annual high tide) and associated dune systems and flats above annual high tide. Intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important. Important components of the beach/dune ecosystem include surf-cast algae for feeding of prey, sparsely vegetated back-beach for roosting and refuge during storms, spits for feeding and roosting, salterns, and washover areas for feeding and roosting.

A final recovery plan for the Great Lakes piping plover population was published on September 8, 2003 (USFWS 2003A). The objective of the recovery plan is to restore and maintain a viable population (95 percent or greater chance of persisting 100 years) to the Great Lakes region and delist the Great Lakes population by 2020. Recovery criteria include: 1) increasing the population to at least 150 pairs (300 adults) with at least 100 pairs (200 adults) in Michigan and 50 pairs (100 adults) distributed among the other Great Lakes states for 5 consecutive years; 2) increasing 5-year average fecundity to 1.5 - 2.0 fledglings per pair per year; 3) adequately protecting essential breeding and wintering habitat; 4) assuring and maintaining adequate genetic diversity over the long-term; and 5) assuring agreements and funding mechanisms are in place for long-term protection and management activities in essential breeding and wintering habitat.

Piping plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, Canada. Historically, as many as 492-682 breeding pairs may have nested in the Great Lakes region in the late 1800s (Russell 1983). Michigan may have had 215 pairs or more; Ontario and Illinois likely supported the next largest populations (152-162 and 125-130, respectively). Indiana, Ohio, and Wisconsin were estimated to have 100 or fewer breeding pairs each, and Minnesota, New York, and Pennsylvania fewer than 30 each.

Piping plovers were extirpated from Great Lakes beaches in Illinois, Indiana, New York, Ohio, Pennsylvania and Ontario by the late 1970s (Russell 1983), coincident with major industrial development and urbanization of the southern lakeshores. Few piping plovers nested in Wisconsin after the 1970s, and no nests were found in the state between 1983 and 1997 (Sumner, Matteson, Wisconsin DNR, pers. comm., 1998 as cited in USFWS 2002a). Similarly, the small number of pairs that nested in Duluth Harbor, Minnesota had abandoned the area by 1986 (Bonita Eliason, Minnesota DNR, pers. comm., 1999 as cited in USFWS 2002a). In 1977, the Great Lakes population was estimated at 31 nesting pairs (Lambert and Ratcliff 1979) but declined to approximately 17 pairs by 1985 (USFWS 1985a). When the piping plover was listed as endangered in 1986, the Great Lakes population nested exclusively at a few sites on the northeastern shore of Lake Michigan and southeastern shore of Lake Superior in Michigan, the state with the most habitat remaining.

Since 1988, protective exclosures have been consistently used to protect all known piping plover nests from predation. The most common design is a 15 m (50 ft) roll of welded wire supported

by fence posts around the nest and topped with monofilament line. Psychological fencing is also used in concert with predator exclosures at most nest sites to limit human activity in the vicinity of piping plover nests. Research indicates that nest exclosures significantly decrease predation on piping plover eggs and chicks (Ivan and Murphy 2005). Psychological fencing consists of bailing twine held in place with fence posts. Michigan DNR “Unlawful to Enter” signs and/or USFWS “Closed Area” signs are attached to the fencing. The closed area varies, depending on the site, and ranges from a small circular area approximately 100 m (330 ft) in radius to larger areas of approximately 800 m (2600 ft) on either side of the territory. Consistent use of exclosures and psychological fencing increased hatching success from 37% to 72% between 1984 and 1999 (Wemmer 2000) and is considered a critical component to piping plover recovery. Additional details regarding the nest exclosures may be found in the Piping Plover Recovery Plan.

From 1986 to 2004, the Great Lakes piping plover population ranged from 12 to 55 breeding pairs. Although this is a substantial increase in population size compared to the previous years, the species remains critically endangered. Reproductive success has also fluctuated among years and may be negatively correlated with increases in lake levels (Wemmer 2000). Fledging success in 2004 was 1.65 chicks fledged per pair, while overall fledging success from 1984 to 2004 is 1.47 chicks fledged per pair. In recent years, the Great Lakes population has gradually increased and expanded to the south and east in Michigan and to the west with pairs breeding in Wisconsin.

Summary and Synthesis of the Species Status

From 1986 to 2004, the Great Lakes piping plover population ranged from 12 to 55 breeding pairs. Reproductive success has fluctuated among years, possibly negatively correlated with lake levels (Wemmer 2000). In recent years, the Great Lakes population has gradually increased and expanded to the south and east in Michigan and to the west with pairs breeding in Wisconsin. Despite substantial increases in population size compared to the previous years, the species remains critically endangered. Several factors threaten the continued existence of piping plovers on Great Lakes beaches, including habitat destruction and modification, predation, inadequate regulatory mechanisms, disturbance by humans and pets, small population size, and contaminants.

Environmental Baseline

This section describes the species status and trend information within the action area. It also includes State, tribal, local, private actions already affecting the species or that will occur contemporaneously with the proposed action. Unrelated Federal actions that have completed formal or informal consultation are also included in the environmental baseline.

Status and Distribution of the Species in the Action Area

Although there are no historic records of piping plovers in the action area, piping plovers have been recently documented on the Forest. In 1999, at least one pair of piping plovers was sighted just outside the HMNF, at the City of Ludington harbor, but no nests were located. In 2002-

2005, up to 4 breeding pairs were documented in Ludington State Park, within designated critical habitat (Unit MI-17). Young and adults from these pairs have been observed on the HMNF, near the southern border, after hatching (USFS 2002a). No piping plover nests were observed on Forest Service lands. This area of the Forest however, is considered suitable piping plover nesting habitat (Jack Dingledine, USFWS, pers. comm. 2003).

The Nordhouse Dunes and Ludington State Park Critical Habitat Unit (MI-17) is approximately 8.3 miles (13.4 km) of Lake Michigan shoreline in Mason County, including portions of the HMNF. It includes areas that were historically occupied by piping plovers. Ludington State Park comprises 3.7 miles (6.0 km) of this unit. The remaining 4.6 miles (7.4 km) are part of the HMNF. This unit extends from the mouth of the Cooper Creek south to the mouth of the Big Sable River. Most of this unit is covered by the Nordhouse Dunes Wilderness area. A small portion is located outside of the wilderness, in the Forest's Lake Michigan Recreation Area. However, this section of the unit does not currently contain all of the PCEs.

While not on the Forest proper, the Tawas State Park Critical Habitat Unit (MI-23), comprising approximately 1.2 miles (2.0 km) of Lake Huron shoreline in Iosco County, lies adjacent to the Forest boundary. This unit includes areas used for foraging by migrating piping plovers and contains suitable nesting habitat. The entire designated area is within Tawas State Park and extends from the Tawas State Park boundary on the east side of Tawas Point and includes all shoreline within Township 22 north, Range 8 east, Section 34 and offshore sand spits. Piping plover were documented to have nested in this area in 2002 (J. Dingledine, USFWS, pers. comm. 2002). A pair was also confirmed at the mouth of the Au Sable River in 2004, with other unconfirmed reports in the area since 2002 (J. Dingledine, USFWS, pers. comm. 2005).

Factors Affecting the Species Within the Action Area

Beginning in 1986, the HMNF operated under the existing Forest Plan, as amended. At that time, the piping plover was proposed for listing as endangered under the Act and the FWS and HMNF engaged in an informal conference under section 7 of the ESA. The outcome of this conference determined that implementation of the LRMP would have no effect on the piping plover because the species was not present on the HMNF and FWS recommended that the HMNF be prepared for movement or reintroduction of piping plover to the Nordhouse Dunes Wilderness Area. The LRMP allowed for management plans for piping plover to be implemented, as necessary. However, since the species was not known to be present on the HMNF, no management plan was developed and no measures specifically for the protection of the piping plover were implemented.

In 2003, the HMNF amended its Forest Plan to include provisions for the piping plover and critical habitat. This amendment included measures that provided specifically for the protection and conservation of piping plover habitat (see Amendment 25, April 2004, USDAFS 1986a). The HMNF and FWS engaged in informal consultation on the effects of the amendment on the piping plover, and determined that the amendment was not likely to adversely affect the piping plover and its critical habitat (USFWS 2003a). The measures provided for in this amendment now provide significant protection and have improved habitat conditions on the Forest.

On the Forest, various land management practices potentially affect piping plover and piping plover critical habitat. These practices primarily include recreation, roads and trails, and other human developments. Further, developments by other landowners or agencies within the boundaries of the Forests (on other ownerships or by authorization on National Forest System land) may affect piping plover. The primary factors affecting piping plover are detailed below in the primary categories of influence.

1. Human disturbance

Human use along shorelines in piping plover nesting habitat may have negative effects on piping plover adults and chicks. The effects may include direct mortality from trampling, harassment of adults and chicks, and nest abandonment. Young cannot regulate their body temperature during the first week of life and depend on the adult for warmth. Repeated flushing of birds can expose both eggs and chicks to temperatures that may cause mortality. Chicks may become separated from adults by pedestrians and may be more susceptible to predators, inclement weather or inaccessibility to preferred habitat (USFWS 2003a). Human disturbance and predators further reduce breeding and wintering habitat quality and affect survival. Generally, increased human use results in an increase in predator species. Unleashed dogs can chase adults, trample eggs and consume eggs or young.

The major recreation uses contributing to disturbance of piping plovers on the Forest includes: beach walking (including pets), swimming, sunbathing, and camping. Access to shorelines may include Forest Service campgrounds, roadside picnic areas, trails, and roadside pull outs.

Most of the potential piping plover habitat on the HMNF is located in the Nordhouse Dunes Wilderness Area, under MA 8.1. The stringent regulations regarding land use in designated wilderness areas has largely preserved the quality of this area for piping plover habitat. However, some of the potential piping plover habitat on the HMNF is located outside the designated wilderness near the Lake Michigan Recreation Area. This area of piping plover habitat has received more human use than the habitat in Nordhouse Dunes Wilderness Area and thus has suffered more impacts, especially from recreational activities.

2. Nest protection

The Piping Plover Recovery Plan specifies protection of nests by use of predator exclosures and limiting human activity in nesting areas with fencing and signs. Nest protection with predator fencing and area closures reduces the loss of eggs and adults from predators and from human disturbance. Other activities at or near nests include population surveys and monitoring; capture, banding, handlings and release of individuals; moving or elevating nests; and salvage activities; and captive rearing efforts in situations where nests are abandoned. The Forest has committed to taking protective measures for piping plover nest that occur on Forest Service lands.

While there are no historic, recent, or current records of piping plover nesting on the Forest, birds have nested very nearby. Each spring the Forest surveys suitable shoreline habitat in Nordhouse Dunes for piping plovers, nest scrapes (nest depressions), or other evidence of nesting on a regular basis.

3. Physical Habitat Management

Non-native invasive species (NNIS) are those species that reproduce very quickly, a trait that enables these plants to dominate natural vegetation. Vectors for NNIS include road construction and maintenance, timber harvest, and recreation activities such as transport on people (i.e. seeds in pockets or attached to clothing), vehicles and OHVs, horses etc. Increased access to an area increases the potential for spread of NNIS. If left unchecked, invasive plant species can quickly take over an area, reducing the available nesting area. Spotted knapweed (*Centaurea biebersteinii*), bladder campion (*Silene vulgaris*), and white sweet clover, are NNIS often found throughout the shoreline and dunes (Heramb 2004). When these species colonize beach habitat, the areas become less suitable or in some cases becomes unsuitable because piping plover need open beach with cobble. Three to five acres of non-native invasive weeds have been pulled in piping plover critical habitat on the Forest over the past two years.

4. Critical habitat primary constituent elements (PCEs)

Most of the Forest's potential piping plover habitat is located in the Nordhouse Dunes Wilderness Area which comprises most of the critical habitat on the Forest. As described in the Status of the Species section, piping plover critical habitat has PCEs that specify the necessary components of critical habitat, including sparsely vegetated, sandy shorelines associated with wide, unforested systems of dunes and inter-dune wetlands; cover for chicks; and a low level of disturbance from human activities and from domestic animals. The stringent regulations regarding land use in designated wilderness areas has largely preserved the quality of this area for piping plover habitat.

Previous Incidental Take Issued for Piping Plover in the Action Area

In December 2004, the FWS and HMNF completed formal consultation with a biological opinion regarding piping plover nest protection activities. This consultation specifically covered actions that the Forest may take to protect any piping plover nests that occur on Forest Service lands. The ITS anticipated up to 5 breeding pairs and their young would be subject to incidental take each year as a result of the proposed action. To date, piping plovers have not nested on the Forest and no incidental take has occurred.

Summary and Synthesis of the Environmental Baseline

While there are historic records of piping plovers in the action area, there has been no nesting in recent years. Since 2002, however, piping plovers have nested very near the Forest and those birds have been observed foraging on the Forest. Most of the potential piping plover habitat on the HMNF is located in the Nordhouse Dunes Wilderness Area. The stringent regulations regarding land use in designated wilderness areas has largely preserved the quality of this area for piping plover habitat. However, some of the potential piping plover habitat on the HMNF is located outside the designated wilderness near the Lake Michigan Recreation Area and has been managed under a management prescription that is less protective for the piping plover. This area of piping plover habitat has received more human use than the habitat in Nordhouse Dunes Wilderness Area and thus has suffered more impact, especially from recreational activities. Each

spring, the Forest surveys suitable shoreline habitat in Nordhouse Dunes for piping plovers, nest scrapes (nest depressions), or other evidence of nesting on a regular basis. Furthermore, the Forest has committed to taking protective measures for piping plover nest that occur on Forest Service lands.

Effects of the Action

This section assesses the effects of the proposed action, including the direct and indirect effects together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). We are not aware of any actions that are interdependent or interrelated to the proposed action being considered in this biological opinion.

Analysis of the Effects of the Action

Effects of the Forest Plan Goals, Objectives, and Desired Conditions on the piping plover

The proposed Plan emphasizes habitat necessary to sustain minimum viable populations that represent existing native vertebrates throughout the Forest. Maintenance and improvement of populations of endangered, threatened, or sensitive species will continue to be a Forest priority.

For the piping plover and other shoreline species, the Forest will manage much of its habitat as a wilderness area with a natural appearance and seclusion. Outside of the wilderness, other shoreline areas receive more intense forest management and use. However, this habitat is still managed for natural conditions with many use restrictions.

The proposed Plan directs that recovery plans for listed species, including the piping plover, be implemented. The proposed Plan also ensures that partnerships will continue by directing cooperation and coordination with responsible government and land and resource management agencies, tribes, and partners regarding endangered, threatened, and sensitive species.

We believe that the overall goals, objectives, and desired conditions of the proposed Plan are consistent with the ecological needs of the piping plover. Implementation of this plan will protect and manage for viable piping plover populations.

Effects of the specific management actions on the piping plover

Although the overall goals of the proposed action are expected to have beneficial effects for the piping plover, the means by which the Forest will achieve its goals may unavoidably cause adverse effects to this species. This analysis assesses the likelihood and magnitude of impacts that may result directly or indirectly from specific proposed management actions or from the long-term operation of management activities. Specifically, we assess the measurable and detectable responses of piping plover exposed to the proposed management actions and the

environmental impacts associated with the actions, and the likelihoods of the exposure and the consequent response occurring.

The program-level analysis lacks definitive temporal and spatial information for future specific management actions. Although the standard and guidelines assist with narrowing our scope of analysis by specifying timing and habitat restrictions, our analyses are necessarily broad. Thus, we identify both the range of possible responses and the most likely responses anticipated for each management activity. Many of the standards and guidelines significantly reduce the potential impacts for piping plover, effectively neutralizing most potential negative responses. However, some potential for negative responses remain.

We focus on the impacts to individual fitness responses (in particular, effects on individual annual and life-time survival rates and annual and life-time reproductive potential). Once we anticipate the individual fitness responses, we then look at how these individual responses affect the fitness of the population in which these individuals belong. Lastly, we assess how the anticipate changes, if any, at the population level will affect the fitness of the species rangewide.

The standards and guidelines that reduce exposure and responses to potential adverse impacts are described in more detail in Proposed Action section. It is important to emphasize that this effects analysis is predicated on the fact that all standards and guidelines will be fully implemented, as intended. If not, this analysis may no longer be valid.

Appendix A deconstructs the actions in the proposed Plan. The table focuses on those proposed Plan actions and effects of most concern to listed species. The table identifies the proposed management actions and associated project elements, the environmental impacts resulting from these project elements, and the likely responses of individuals exposed to these environmental impacts. It also describes the anticipated effects to the affected population in terms of reproduction, numbers, and distribution. These tables were intended to be read in concert with the following effects analysis section.

- Range Management

The four active grazing allotments on the Forest are not within piping plover habitat and the shoreline/dune area does not provide suitable grazing pasture or hay cutting material. We do not expect piping plover or critical habitat to be exposed to any range management activities.

- Timber Management

All timber management activities are performed outside of dune and shoreline habitats. We do not expect piping plover or critical habitat to be exposed to any timber management activities.

- Watershed Management

Watershed management activities are prohibited in potential piping plover habitat. We do not expect piping plovers or critical habitat to be exposed to any watershed management activities.

- Minerals and Geology

Strict State and Federal laws regulate all resource extraction in dune habitats. Surface occupancy for resource extraction is prohibited under the following circumstances: 1) within 300 ft (92 m) of Lake Michigan, 2) in State-designated Critical Dune habitat, and 3) in the Nordhouse Dunes Wilderness Area, and 4) in any occupied piping plover habitat or designated critical habitat. These restrictions cover all piping plover habitat on the Forest and we do not expect this species or critical habitat to be exposed to any minerals and geology management.

- Fire Management

Fire management activities on the Forest are focused on areas with a high fuel hazard (i.e., forested areas) or on areas targeted for Karner blue butterfly habitat restoration. The piping plover is not found in either of these habitat types. Wildfires (natural or human caused), while possible, are uncommon in dune habitats. Therefore, we do not expect piping plover or critical habitat to be exposed to fire management activities.

- Transportation System

Currently, there are no roads for motorized use in the dune and shoreline areas with piping plover habitat or critical habitat. Furthermore, roads are prohibited in the Nordhouse Dunes, in the Research Natural Area, and in shoreline and dune piping plover habitats. Roads that facilitate access into piping plover habitat may indirectly impact this species by increasing human disturbance and introduction of invasive exotic species. However, these potential impacts have been greatly reduced or avoided because the Forest has eliminated road access into potential piping plover areas. Future impacts will be further minimized because there are only two indirect access points that provide only foot traffic access. Therefore, we do not expect transportation management to have any measurable impacts on piping plover or critical habitat.

- Forest Pest Management

Non-native invasive plant species (NNIS) are impacting dune habitats on the Forest, particularly spotted knapweed and Lombardy poplar. The Forest will control occurrences of problem exotic species using Integrated Pest Management techniques, including hand-pulling, cutting, and herbicide use. The Forest will minimize herbicide use to control of those NNIS where the current scientific literature indicates that other methods are ineffective or cost-prohibitive. Currently, Lombardy poplar fits into this category. In occupied piping plover habitat, the Forest will control NNIS in a manner that ensures that exposure of individual piping plovers is extremely unlikely. Moreover, activities that reduce the spread and infestation of NNIS should improve piping plover habitat by minimizing dune stabilization and increasing biodiversity, enhancing reproductive success and survival rates. Therefore, we do not expect forest pest management to have any measurable impacts on piping plover or critical habitat.

- Wildlife, Fish, and Sensitive Plant Management

Management actions for wildlife, fish, and sensitive plants for most species are not used in dune habitats and piping plover will not be exposed to these activities. In addition, many actions that will improve habitat or otherwise minimize potential adverse impacts species on the Forest are expressed as standards and guidelines for other management activities, and will not be discussed here.

The Forest will undertake management activities as directed by the Piping Plover Recovery Plan. The primary activities prescribed by the plan for management of piping plover are nest protection measures. As a whole, we expect these actions to increase survivorship, enhance reproductive success, expand the range, and contribute to the recovery of piping plover on the Forest.

Population surveys and monitoring using direct observation- Surveys will be conducted from April to August every year to determine the presence and abundance of piping plovers within the Forest. If nesting is not documented, monitoring efforts may be decreased in July and August, when the likelihood of new nesting is diminished. Once nests are identified, Forest Service staff will monitor nesting behavior, incubation, and brood rearing. Forest Service staff may also monitor piping plovers and their nesting and feeding activities as part of life history or food choice studies. Forest Service staff or approved volunteers may patrol active breeding areas and educate the public about threats to piping plovers. Piping plovers will be observed from a distance using either binoculars or spotting scopes.

Surveys may involve walking through and adjacent to occupied habitat to observe piping plovers. This may result in temporary disruption of feeding, mating, and nesting activities. Except on rare occasions, these impacts should not cause injury or death of piping plovers. To minimize potential adverse impacts to the extent possible, Forest Service staff will be trained in proper procedures for surveys and monitoring. The USFWS written protocols covering these activities have been developed and will be used during monitoring. Surveys and monitoring will also be subject to regular field review by USFWS East Lansing Field Office staff.

Nest and nesting habitat protection activities- Wire enclosures and psychological fencing will be erected around all known piping plover nests to help protect nests from predators. Possible negative impacts include nest abandonment, temporary harassment of individuals, entanglement of adults in the monofilament line or blueberry netting that is topping enclosures, and rarely, increased predation. All Forest Service staff constructing predator enclosures must have completed a USFWS approved training course and be authorized to do so by the USFWS. Persons authorized to erect enclosures will be familiar with the biology and behavior of piping plovers to reduce disturbance as much as possible. Despite the rare case where an enclosure may actually increase predation or lead to other adverse impacts, predator enclosures and psychological fencing have been shown to increase hatching success and therefore provide a net benefit to the species. Except on rare occasions, these impacts should not cause injury or death of piping plovers.

As previously explained in the Status of the Species section, disturbance by humans and pets is a primary threat to the piping plover on Great Lakes beaches. Disturbance by humans and pets may deter plovers from using nesting or foraging habitat, cause chicks to become separated from their parents, or cause parents to desert their nests, leaving eggs or chicks exposed to summer sun and predators. Dogs frequently chase and attempt to capture adults and chicks.

The Forest will undertake a variety of actions to protect piping plovers from potential human-related disturbances. The previously described exclosures and fencing will serve to prohibit humans from nesting areas. Additional actions, such as beach closures, vehicle traffic restrictions, recreational activities prohibitions, dog leash requirements, and litter and debris removal will also be implemented as appropriate. These activities are expected to minimize potential take of piping plovers due to human disturbance.

Implementation of a dog leash requirement will likely decrease potential disturbance from dogs; however, potential take of piping plovers remains. Leash requirement rules are difficult to enforce at all times and dog owners may disregard the rule and let their dogs run off leash. This issue is increasingly difficult to address in remote places, such as Nordhouse Dunes Wilderness Area, where a consistent enforcement presence is logistically difficult to maintain. Where dogs are not expressly prohibited from piping plover habitat, there may still be take due to non-compliance with the leash rule.

Techniques involving capture, handling, banding, and release of individuals- Although U.S. Forest Service employees are not likely to be directly responsible for the capture and handling of piping plovers, banding activities on Forest Service lands must have Forest Service approval, and Forest Service staff may assist in the banding activities. Piping plovers may suffer adverse impacts in the form of pursuit, capture, harassment, or mortality as a result of capture-and-release related activities. Nesting piping plovers will be trapped for banding on their nests but only after the first week of incubation and during fair weather. Chicks will be hand-captured and banded. Personnel will capture and band piping plovers with USFWS aluminum or other metallic bands and a unique plastic color band combination. All captured piping plovers will be released following banding. Possible incidental impacts of capture and banding include injury, nest desertion, hatching failure, and egg and chick mortality.

All Forest Service staff involved in banding will take many safety precautions to minimize disturbance to nesting plovers. Only trained Forest Service staff will be allowed to assist with banding activities, thereby reducing the probability of harm. Affected piping plovers will be temporarily disturbed but are not likely to suffer any long-term effects. Analysis of banding data from 1993-1997 indicated that injury during trapping and as a result of banding was infrequent, and no mortalities were reported. Rates of nest desertion and hatching success for nests where individuals were trapped and banded did not differ significantly from nests where trapping and banding procedures were not conducted (Wemmer and Cuthbert 1999). Intensive population monitoring during the breeding season will reveal if band-related injuries are occurring. All injury observations are to be reported to the USFWS East Lansing Field Office.

Moving or elevating nests- There are some circumstances under which a piping plover nest may be moved or elevated to avoid loss due to a natural and imminent threat. For example, if a nest is

too close to the water's edge, rising water levels could submerge the eggs. Following contact with staff from the USFWS East Lansing Field Office, Forest Service staff may be authorized to move the nest further from harm or elevate the nest. Despite precautions, these activities may cause the pair to abandon the nest. This is expected to be very limited, however, due to training of researchers and adherence to appropriate protocols. If it is determined a nest should be moved or elevated, it will be done gradually (i.e., by moving short distances or elevating in short increments) to reduce the potential for abandonment. Nests will be monitored frequently during and after the movement to confirm piping plovers have returned to incubate. These procedures have been used successfully in the past to avoid the loss of nests. Both nest moving and elevating have been done at nest sites in Michigan, without abandonment of adults.

Forest Service staff with the appropriate level of training and expertise may perform these activities, but only with prior approval of the USFWS East Lansing Field Office. This will minimize the possibility of incidental take involved with such actions.

Salvage captive rearing activities- Salvage captive rearing has been a technique used since 1992 to increase the overall reproductive success rate of Great Lakes piping plovers. This activity involves removing abandoned eggs and/or chicks from the wild and rearing them in captivity at the University of Michigan Biological Station in Pellston, Michigan. Upon reaching the fledging stage, all captive reared individuals are released in proximity to the collection site and within the same breeding season. Researchers from the University of Minnesota oversee the program with assistance from staff from American Zoo and Aquarium association accredited Zoos.

The Forest Service may participate in the salvage of abandoned piping plovers for captive rearing purposes. Eggs and young may only be collected for salvage after observation of strong evidence of parental abandonment and when coordination with USFWS suggests that the eggs or young should be collected for salvage. A formal nest abandonment protocol has been developed and will be closely followed by all Forest Service staff.

The Forest will capture and/or collect abandoned eggs or chicks for salvage captive rearing. Per regulation, Forest Service employees are allowed, in the course of their regular duties, to aid a sick or injured bird and collect dead birds without exemption or permit from the USFWS (50 CFR 402 part 17.21). However, some mortality of eggs during transport to UMBS or injury/death to chicks during collection, transport, incubation, rearing, or release back into the wild may also result from these activities. Well-established protocols exist for collection, transport, incubation, rearing, and release, and only trained individuals are allowed to carry out these protocols. Therefore, incidental take during captive rearing activities will be minimal.

The USFWS will allow any number of abandoned individuals, in any combination of eggs or chicks, to be taken annually for salvage captive rearing, as long as adequate facilities exist for proper care and rearing.

Predator control efforts- The Forest Service may participate in predator control activities, as necessary and prudent. Natural predators continue to represent a limiting factor in Great Lakes piping plover reproductive success. Potential predator management efforts are being considered at a select number of current breeding locations off the Forests. Control efforts may be

considered after evaluation of nesting success and determination of actual predators, such as crows, gulls, ravens, coyotes, fox, raccoons, and others. All predator management programs will include extensive piping plover monitoring to assure any disturbance to nesting plovers remains minimal. If signs of disturbance are observed, predator control methods will be modified, redirected or halted.

Salvage of dead eggs, young, and adults- Forest Service staff may salvage abandoned, nonviable eggs or dead adults or young to make them available for the USFWS to conduct contaminant, genetic, or food intake analyses or to determine cause(s) of mortality. As previously discussed, Forest Service employees are allowed, in the course of their regular duties, to aid a sick or injured bird and collect dead birds without exemption or permit from the USFWS (50 CFR 402 part 17.21). Live piping plover young, adults, or eggs near dead individuals or nonviable eggs may be disturbed during collection of dead individuals, but the disturbance is not anticipated to reach the level of take. Only trained Forest Service staff with proper authorization will be allowed to salvage dead adults or young and/or nonviable eggs. Salvages will be reported to the USFWS within 24 hours of occurrence.

- Recreation Management

Recreational activities are very popular in the dunes and shoreline that provide potential habitat including designated critical habitat for the piping plover. Specifically, camping, walking, and other beach-related recreational activities are popular. Motorized vehicles, however, are prohibited. A 1995 Nordhouse Dunes Wilderness Use Study indicated that 10,000 Recreational Visitor Days (RVDs) were occurring in the Wilderness. In 2001, Recreation Fee Demo use information indicates that use has remained approximately the same (HMNF 2001). Lake Michigan Recreation Area campground use in 1995 was 27,600 RVDs and by 2001 data showed that it had increased to 32,000 RVDs (HMNF 1995, 2001a). This is a 16 percent increase in use at the Lake Michigan Recreation Area campground. Although this campground is open year-round, almost all the use is from May 15 to September 10, during the same time period that piping plovers would use the area.

Standards and guidelines limit many activities that might disrupt the piping plover in the Nordhouse Dunes Wilderness Area. The use of any mechanized or motorized equipment such as vehicles, bicycles, and wheeled carts is prohibited. All pets are required to be on a leash when on the beach. The overall lower level of use typical of a wilderness area reduces potential disturbance and littering which can attract predators and scavengers, such as gulls, crows, skunks, opossums, raccoons, and foxes that may eat eggs and chicks. Group size is limited to 10 people or less. Horses, storage of property or supplies, and camping along the shoreline are prohibited. Beach fires are not allowed, campsites must be 400 feet (122 m) from the lake, and the collecting of driftwood and dune wood is prohibited. Parking is controlled by the designated trailheads that have limited occupancy or space. There are two Forest Service access points into Nordhouse Dunes Wilderness, one at Nurenberg Trailhead and the other is access by trail from the Lake Michigan Recreation Area. This helps control the amount of potential human disturbance to piping plover and designated critical habitat.

Most of these standards and guidelines do not apply in the Lake Michigan Recreation Area, and the area typically has greater, less restricted visitor use. In addition, this area has a large developed campground that attracts and concentrates visitor use. However, the proposed Plan also identifies standards and guidelines specifically that apply to all piping plover critical habitat on the Forest (wilderness and otherwise). These standards and guidelines limit foot traffic, kite flying, loud noise, and other potentially disturbing activities in and around nest sites. As previously described, standards and guidelines also require nest protection activities, as necessary.

The Forest will further reduce the potential adverse impacts from recreational activities to the piping plover and designated critical habitat through the following standards and guidelines:

- As feasible and prudent, management activities and recreational use would utilize seasonal avoidance measures.
- Seasonal restrictions and closures of critical habitat (for example, during periods used for nest site selection, egg laying, and incubation) help eliminate detrimental piping plover to human interactions.
- Habitat modifications are limited to those that maintain or improve the habitat and minimize potential adverse impacts, such as maintaining an early successional (sparsely vegetated) community, maintaining relatively low human use, and controlling invasive and/or exotic plants that could adversely affect the habitat.

The standards and guidelines, along with active nest protection activities (described in wildlife, fish and sensitive plant management), should be effective at controlling impacts from recreation. Under many circumstances, the Forest will reduce impacts to the extent that recreation should have no detectable impact on piping plovers. However, potential for some adverse impacts remains, specifically from violations of closed areas and other protective restrictions, such as leash requirements for pets. Human activities also tend to attract scavengers, such as gulls and foxes, that may prey upon piping plover adults, chicks, and eggs. Under these circumstances, disturbance of pairs may cause them to permanently or temporarily abandon their nests. Temporary abandonment leaves eggs and chicks exposed to predation and interrupts incubation. This may cause the death of eggs or chicks. Permanent nest abandonment is also likely to cause the death of eggs and chicks.

The effects of recreational activities on piping plover critical habitat can be gauged by their potential impacts to the PCEs. Recreation management forest may affect the PCE that requires a low level of disturbance. However, the area of piping plover critical habitat on the Forest that contains the PCEs is located in the Nordhouse Dunes Wilderness Area. As previously discussed, the wilderness has numerous standards and guidelines that minimize human activities and maintains the non-consumptive, low impact uses that are typical of the wilderness. These measure are generally effective at minimizing potential for human activity, and thus we do not believe that recreational management will negatively impact piping plover critical habitat.

Cumulative Effects

Cumulative effects include the combined effects of any future State, local, or private actions that are reasonably certain to occur within the action area covered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Potential cumulative effects could impact piping plovers in the other areas of private ownership on the Forest. Human activities, including development, recreation, and roads to the shoreline are present and may be expected to continue in these areas. If performed in piping plover habitat, these activities may have a progressive negative impact on the species within the action area.

Shoreline areas are also highly sought after as sites for vacation homes or resorts and are highly vulnerable to ongoing shoreline development and intensive recreation. Many of these areas, however, are protected as “critical dunes” under the Michigan’s Sand Dunes Protection and Management Program, part of 353 of the Natural Resources and Environmental Protection Act, 1994 PA 451. Part 353 establishes protective standards on dunes considered to be the most sensitive. Such areas are protected from most development, which should provide substantial protection for piping plover habitat.

Water level fluctuations may affect piping plovers. During periods of high water there is a reduction in the amount of beach habitat available for nesting plovers. Water fluctuations have been recorded over the past 80 years. The years with maximum Great Lake levels were 1973 and 1985. The years of minimum Great Lake levels were 1926, 1934 and 1936 (US Army Corp Engineers 2004). Water level fluctuations will continue to occur in the Great Lakes, increasing the potential for destruction of lost piping plover nests during periods of high water. In 2004, water levels rose from the 2003 level in Lake Michigan, causing the loss of some piping plover nests early in the nesting season. During periods of high water, less shoreline habitat would be available as nesting habitat. During periods of low water, beach succession would occur, a condition that would also reduce the amount of nesting habitat available to piping plover.

The development of privately-owned mineral rights is possible on both private and Forest Service lands. Mineral rights on Federal lands are subject to an environmental analysis, review, oversight, and permit from the Federal agency. The Federal agency, however, may not be able to condition a permit in a manner that would preclude the development of the resource. In such cases, the Forest may not be able to impose a “no surface occupancy” stipulation in the permit for mineral extraction in occupied habitat, and the species may be adversely affected. However, since there are no known mineral developments that are reasonably certain to occur, we cannot presently account for them into our jeopardy analysis for this species.

Conclusion

After reviewing the current status of the piping plover, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the piping

plover. In addition, we do not anticipate that the proposed action will adversely affect piping plover critical habitat.

There are likely to be adverse effects to the piping plover in the action area as a result of recreation management and nest protection activities. These adverse effects are expected to be in the form of harassment, injury, and death of piping plovers, resulting primarily from human activities. The Forest has committed to avoiding or reducing these impacts by limiting and managing recreational activities, as necessary. Furthermore, the Forest will ensure that all nest protection activities follow USFWS guidelines and are only implemented by appropriately trained staff. We believe that, while the potential for adverse effects remains, the proposed action taken together with cumulative effects is not reasonably expected to, directly or indirectly, reduce appreciably the likelihood of both the survival and recovery of the piping plover in the wild by reducing the species' reproduction, numbers, or distribution within the action area. Moreover, we do not believe that the proposed action will adversely modify piping plover critical habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

In general, an incidental take statement (ITS) specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize the impacts of the take and sets forth terms and conditions which must be complied with in order to implement the reasonable and prudent measures.

Amount or Extent of Take

This ITS evaluates the incidental take of piping plovers that may result from implementation of the proposed Plan. The standards and guidelines within the proposed Plan significantly reduce the potential for adverse effects and incidental take to occur. In fact, we anticipate that the standards and guidelines will effectively avoid adverse impacts and incidental take from individual future projects. In other words, we do not anticipate future projects completed under the proposed Plan will cause adverse impacts or incidental take of piping plovers. However, we

do anticipate that, over this planning period, the cumulative impacts of general management in the Forest's dune and shoreline habitats will cause some adverse effects and incidental take of piping plovers. We further believe that we have sufficient information regarding potential for take over the life of the proposed Plan to anticipate it in this Plan level ITS, as described below.

This section addresses only a subset of the adverse effects analyzed in the Effects section. Specifically, we identify the effects that will: 1) rise to the level of take and are reasonably certain to occur, and 2) are within the action agency's discretion. Thus, adverse effects that are not expected to rise to the level of take, are not reasonably certain to occur, or are not under the jurisdiction of the action agency are not analyzed in this ITS.

To date, piping plovers have not been documented nesting on the Forest. However, birds have been observed foraging on the Forest and they have also been recently nested in Ludington State Park, as close as one-half mile from the Forest boundary. Given this activity and the generally excellent habitat quality in the Nordhouse Dunes, we believe that piping plovers are likely to nest on the Forest in the near future.

- Recreation

As discussed in the accompanying biological opinion, recreation management may adversely impact piping plovers on the Forest. The standards and guidelines in the proposed Plan, along with active nest protection activities (described under the wildlife, fish and sensitive plant management section), will be very effective at controlling impacts from recreation. However, potential for some adverse impacts remains, specifically from violations of closed areas and other protective restrictions, such as leash requirements for pets. Under these circumstances, disturbance of pairs may cause them to permanently or temporarily abandon their nests. Temporary or permanent nest abandonment leaves eggs and chicks exposed to predation and interrupts incubation. This may cause the death of eggs or chicks. Thus, while the proposed Plan implements many standards and guidelines to minimize potential impacts, take from illegal activity associated with recreation management is still reasonably certain to occur.

Any take that occurs due to illegal activities is outside the jurisdiction and authority of the Forest Service and not exempted by this ITS and therefore not the responsibility of the Forest Service. However, our effects and jeopardy analyses are predicated on the Forest's taking all reasonable measures to protect nests (i.e., fully implementing the nest protection standards and guidelines in the proposed Plan) and an anticipated level of disturbance from illegal activities. Although we are not exempting incidental take associated with illegal actions, it is necessary to monitor the occurrence and extent of such activity to ensure that the actual impact of such take that occurs is commensurate with the anticipated impact analyzed in the accompanying biological opinion. Thus, Forest is required to monitor the frequency and extent of impact that will occur from illegal activities. If, through monitoring, it is determined that the impact associated with illegal recreational activity exceeds what we have anticipated within, the Forest must consult with the USFWS to determine if reinitiation of consultation is necessary.

- Nest protection

Nest protection activities, while essential to the survival of piping plovers, may also cause some take of individuals. While the Forest will follow USFWS protocols, take is still reasonably certain to occur. The incidental take is expected in the form of harm or harassment and, possibly death or injury of piping plover adults, chicks, and eggs. The amount of take will vary by nest depending on the developmental status of the young (i.e., eggs or chicks present) and the number of individual birds present. Therefore, when we refer to take in terms in nests, this is inclusive of eggs or chicks, whatever is present.

Population surveys and monitoring using direct observation

Although incidental take in the form of harassment may occur on rare occasions during population surveys or monitoring of nesting piping plovers, none is anticipated or authorized because only trained and authorized individuals are allowed to participate in this activity. Furthermore, no lethal take is anticipated or authorized due to population surveys or monitoring.

Nest and nesting habitat protection activities

Wire enclosures and psychological fencing are currently erected around all piping plover nests to help protect nests from predators and human disturbance. Regular use of these protective measures has resulted in an increase in piping plover nest success in the Great Lakes. These protective measures will necessarily cause harassment, in the form of temporary nest flushing. For every nest protected. It is possible that additional negative effects, such as harassment, nest desertion, entanglement of adults in the monofilament line enclosure topping, and rarely, related predation. In general, proper application of nest protection measures is not expected to result in adverse effects that rise to the level of lethal take. However, piping plovers may be subject to injury or mortality as a result of these activities, but these outcomes are expected to occur only occasionally. As a result, lethal take is not expected in all cases where nest protection is implemented. If it is determined that nest abandonment, increased predation or entanglement occur as a result of nest enclosures, activities will be modified. Incidental take in the form of nest abandonment, increased predation or entanglement will be allowed for up to 1 nest during any one breeding season.

Techniques involving capture, banding, handling, and release of individuals

Forest Service staff may participate in piping plover banding activities, including capture, handling, and release of individuals. These activities necessarily involve harassment of banded birds, and this form of take is authorized for all banded adult and young birds. While the Forest Service permits and participates in these activities, they are actually performed by an outside researcher. These researchers are expected to have the proper permitting (e.g., section 10(a)(1)(A) permit) and any take that may result from those activities would be addressed under the associated section 7 consultations.

Moving or elevating nests

A very limited amount of incidental take is anticipated to occur as a result of moving or elevating nests. Up to 2 nest abandonments will be allowed for each year as a result of nest moving or elevating. Only nests that face an imminent threat of loss will be subject to movement (after

prior approval from the USFWS East Lansing Field Office, as committed to in the proposed action). As a result, nest moving is expected to minimize loss of piping plover nests.

Salvage captive rearing activities

Forest Service staff may transport eggs or chicks for captive rearing and transport for release back into the wild. Well-established protocols (on file at ELFO) exist for collection, rearing, and transport, and only trained and authorized individuals are allowed to carry out these protocols. Per regulation, Forest Service employees are allowed, in the course of their regular duties, to aid a sick or injured bird and collect dead birds without exemption or permit from the USFWS (50 CFR 402 part 17.21). However, lethal take of a sick or injured bird requires an incidental take exemption. If following protocols, incidental take due to injury or mortality during captive rearing activities is not anticipated to exceed 1 nest annually. This does not include eggs or chicks that are lost due to natural causes. Natural mortality in the population may be partially offset by the observed long-term benefits of captive rearing.

Predator control efforts

No incidental take is anticipated as a result of predator control efforts. Although some disturbance may occur during implementation of predator management activities, it is not expected these will rise to the level of take. Continual monitoring during predator management will minimize the potential level of disturbance.

Salvage activities

Salvage of dead individuals or of nonviable eggs should not result in any adverse effects to piping plovers. Therefore, no incidental take is anticipated.

Effect of the Take

In the accompanying biological opinion, we determined that the level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat. As explained, the primary purpose of the action proposed by the Forest is to provide for the conservation of piping plover. Despite some unavoidable short-term adverse effects, the proposed action will contribute to the long-term conservation and recovery of the species. Thus, the proposed action is not likely to appreciably reduce the likelihood of survival or recovery of the piping plover or adversely modify or destroy critical habitat.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize the incidental take authorized by this biological opinion.

- Conduct all piping plover nest and nesting habitat management activities in a manner that minimizes take to the maximum extent practical.

Terms and conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must comply with the following term and condition which implement the reasonable and prudent measure described above. Terms and conditions are non-discretionary.

1. Authority to capture and handle piping plover will be granted only to persons experienced in the handling and the biology of the species.
2. Ensure that all Forest Service employees and contractors working near piping plover critical habitat are educated to recognize and avoid piping plovers and critical habitat components.

Requirements for Monitoring and Reporting of Incidental Take of the piping plover

Federal agencies have a continuing duty to monitor the impacts of incidental take resulting from their activities [50 CFR 402.14(i)(3)]. In doing so, the Federal agency must report the progress of the action and its impact on the species to the Service as follows.

1. Supply the Service's East Lansing Field Office with an annual report, due by January 31st each year, that outlines the following:
 - a. Results of all monitoring activities, including:
 - i. Number of piping plovers observed including leg band combinations
 - ii. Number of piping plover nests and number of young fledged
 - iii. Incidents of take
 - iv. Compliance with area closures and requirements for leashed-pets
 - b. Progress and results of terms and conditions.
2. All incidental injuries or mortalities must be reported within 24 hours to the Service's East Lansing Field Office. Immediately report the finding of any dead specimen to the Service's East Lansing Field Office. Care must be taken in handling dead specimens that are found on the Forest to preserve biological material in the best possible condition. Any dead specimens found should be placed in plastic bag and refrigerated as soon as possible following discovery.

We anticipate that harassment of all protected piping plovers annually resulting from nest protection activities on the Forest is reasonably certain to occur. We further anticipate take of 4 nests from nest protection, moving or elevating nests, or salvage captive rearing activities. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We believe that the HMNF has already initiated or participated in important efforts to protect, manage, and increase our understanding of the piping plover, including their commitment to implement the Conservation Measures in the proposed action. We offer the following Conservation Recommendation to further expand the knowledge of this species, and help better manage for the piping plover in Michigan.

- Explore ways to increase compliance with pet leash requirements and prohibiting dogs from potential piping plover habitat. Undertake outreach and education to inform the public about the threats of dogs to piping plovers.
- Participate in recovery implementation and adaptive management with the USFWS and other piping plover recovery partners.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

Indiana bat

Status of the species and critical habitat

This section presents the biological or ecological information relevant to formulating the biological opinion. The purpose is to provide the appropriate information on the species' life history, its habitat and its range-wide distribution and conservation status for analyses in later sections. This section also documents the effects of all past human and natural activities or events that have led to the current status of the species.

Species Description

The Indiana bat is a medium-sized, monotypic species (there are no subspecies) of the genus *Myotis*. Its forearm length is 1.4 to 1.6 in (35 to 41 mm). The head and body length ranges from 1.6 to 1.9 in (41 to 49 mm). This species closely resembles the little brown bat (*M. lucifugus*) and the northern long-eared bat (*M. septentrionalis*). The Indiana bat usually has a distinctly keeled calcar. The hind feet tend to be small and delicate with fewer, shorter hairs (do not extend beyond the toenails) than its congeners. The fur lacks luster (Hall 1981; Barbour and Davis 1969). The ears and wing membranes have a dull appearance and flat coloration that do not contrast with the fur. The fur of the chest and belly is lighter than the flat (not glossy), pinkish-brown fur on the back, but does not contrast as strongly as does that of the little brown bat or

northern long-eared bat, for example. The skull has a small sagittal crest, and the braincase tends to be smaller, lower, and narrower than that of the little brown bat (Hall 1981; Barbour and Davis 1969).

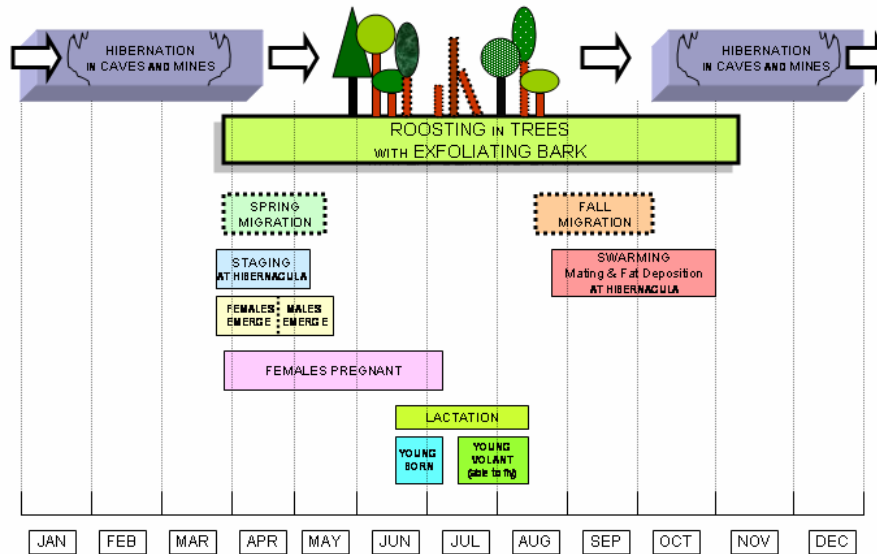
Life History

Indiana bat annual cycle includes 4 major phases: winter hibernation, spring migration, summer maternity period, and fall migration/swarming (Figure 2). Generally, Indiana bats hibernate from October through April (Hall 1962; LaVal and LaVal 1980), depending upon local weather conditions. Bats typically form large, single-layer clusters on cave ceilings in densities ranging from 300-499 bats per square foot (Clawson et al. 1980, Stihler 2005). Hibernation facilitates survival during winter when prey is unavailable. However, the bat must store sufficient fat to support metabolic processes until spring. Substantial risks are posed by events (e.g., human disturbance) during the winter that interrupt hibernation and increase metabolic rates (Johnson et al. 1998).

After hibernation ends in late March or early April, most Indiana bats migrate to summer roosts. Female Indiana bats emerge from hibernation prior to males. The period after hibernation and just before spring migration is typically referred to as “staging”, a time when bats forage and a limited amount of mating occurs (Hall 1962, Cope and Humphrey 1977). Most bats leave their hibernaculum by late April. Migration is stressful for the Indiana bat, particularly in the spring when their fat reserves and food supplies are low and females are pregnant. As a result, adult mortality may be highest in late March and April (Thomson 1982).

Summering Indiana bats typically day roost under exfoliating bark of trees in riparian, bottomland, and upland forests. In summer, male bats roost individually or in small groups and either remain near their winter hibernaculum (some actually may use their hibernaculum as their summer day roost instead of trees) or disperse throughout the range. In contrast, reproductive females form larger groups referred to as maternity colonies, which are often far removed from hibernacula areas. Roost trees are most often snags (i.e., dead trees) with variable amounts of exfoliating bark, which allow bats to roost between the bark and bole of the tree. However, live, shag-barked trees (e.g., *Carya ovata*) are also used, as well as some trees with cavities and crevices. Because snags of a wide variety of tree species are used for diurnal roosts including maple (*Acer* spp.), hickory (*Carya* spp.), ash (*Fraxinus* spp.), oak (*Quercus* spp.), elm (*Ulmus* spp.), pine (*Pinus* spp.), hemlock (*Tsuga canadensis*), and others (Menzel et al. 2001, Kurta et al. 2002, Britzke et al. 2003), it seems that bats select roosts based on their structure rather than species of tree. Maternity colonies typically consist of at least one relatively large roost tree (>22 cm dbh) with loose, exfoliating bark and a high-degree of solar exposure, whereas solitary males are much less constrained and can use much smaller trees (>6.4cm; Menzel et al. 2001, Gumbert 2001). Predominately, Indiana bat roost sites are in trees, however, a few males and maternity colonies have been documented roosting in bat boxes (Carter 2002) and other man-made structures (e.g., an old church attic, a barn, and a wooden high-power pole; Butchkoski and Hassinger 2002, Cheng 2003, Hendricks et al. 2004).

Figure 2. The annual lifecycle of Indiana bat



Most summer days/nights, adult females may form multiple roosting subgroups, spread among different trees within the colony's roosting area, thus forming what appears to be a fission-fusion type of society resembling those of some cetaceans, primates, and other colonial bat species (Kerth and König 1999, Kurta et. al 2002, Willis and Brigham 2004). Because females frequently switch roost sites (Kurta et al. 2002, Brack et al. 2004), a maternity colony may use 18 or more roost trees in a single season (Barclay and Kurta 2004). Maternity colonies usually contain 100 or fewer adult female bats although colonies larger than 300 have been reported (Whitaker and Brack 2002). The fission-fusion society of these bats causes roosting numbers to fluctuate unpredictably at individual roost trees, so estimating actual size of an entire "colony" is very difficult; typically requiring multiple emergence counts to be conducted simultaneously by different observers stationed at all known roost trees.

Females each give birth to a single young between mid June and early July and young Indiana bats are volant (i.e., capable of flight) within a month of birth. They spend the latter part of the summer foraging to accumulate fat reserves for the fall migration and hibernation. Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas from year to year (Kurta and Murray 2002). Traditional summer sites are essential to the reproductive success of local populations. It is not known how long or how far female Indiana bats will search to find new roosting habitat if their traditional roost area is lost or degraded.

Because Indiana bat roost sites are ephemeral, a continuous supply of currently suitable and future roost trees are needed within a colony's traditional summer area for the colony to persist in the area over time. Indiana bat maternity sites generally consist of one or more primary maternity roost trees which are used repeatedly by large numbers of bats, and varying numbers of alternate roosts, which may be used less frequently and by smaller numbers of bats. Bats move among roosts within a season and when a particular roost becomes unavailable from one year to the next.

Indiana bats eat terrestrial and aquatic insects while foraging in forested stream corridors, upland and bottomland forests, and over impounded bodies of water at night (Whitaker 1972, Lee 1993, Murray and Kurta 2002). Indiana bats tend to avoid vast open spaces, so wooded corridors linking roosting sites with foraging areas are important in areas where forests are fragmented (Murray and Kurta 2004).

After the summer maternity period, Indiana bats migrate back to traditional winter hibernacula. Some male bats may begin to arrive at hibernacula as early as July. Females typically arrive later and by September numbers of males and females are almost equal (Cope and Humphrey 1977). Autumn "swarming" occurs prior to hibernation. During swarming, bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in the caves during the day (i.e., they continue to use trees near the caves as their day roosts). The swarming period is a critical period in their annual cycle. During this time they forage to build up their fat reserves to sustain them through winter hibernation and they mate. By late September, many females have entered hibernation, but males may continue swarming well into October. Mating takes place during this period and females store sperm through the winter and delayed fertilization occurs in the spring (Thomson 1982).

Habitat Use and Requirements

Winter Habitat-Hibernation. Generally, Indiana bats hibernate from October through April depending upon local weather conditions. Bats cluster on cave ceilings during hibernation and are capable of clustering in dense groups typically ranging from 300-484 bats per square foot. Hibernation facilitates survival during winter when prey are unavailable. However, the bat must store sufficient fat to support metabolic processes until spring. Substantial risks are posed by events during the winter that interrupt hibernation and increase metabolic rates.

Temperature and relative humidity are important factors in the selection of hibernation sites. During the early autumn, Indiana bats roost in warm sections of caves and move down a temperature gradient as temperatures decrease. A recent study of highly populated hibernacula documented a temperature range of 3-7.2°C (Tuttle and Kennedy 2002). Relative humidity in Indiana bat hibernacula is usually above 74% but below saturation (Hall 1962; Humphrey 1978; LaVal et al. 1976), although relative humidity as low as 54% has been observed (Myers 1964).

After hibernation ends in late March or early April, most Indiana bats migrate to their traditional summer areas. Female Indiana bats emerge from hibernation in late March or early April, followed by the males. The period after hibernation but, prior to migration, is referred to as staging. Most individuals leave their hibernacula by late April. Migration is stressful for the Indiana bat, particularly in the spring when their fat reserves and food supplies are low. As a result, adult mortality may be the highest in late March and April.

Female Maternity Colony-Summer Habitat. Upon emergence from the hibernacula in the spring, females migrate to their traditional maternity colony areas. Coloniality is a requisite behavior for reproductive success. Females usually start grouping into larger maternity colonies by mid-May and give birth to a single young between late June and early July (Humphrey et al. 1977). These colonies are typically located under the sloughing bark of live, dead and partially dead trees in

upland and lowland forest (Humphrey et al. 1977; Gardner et al. 1991). Colony trees are usually large-diameter, standing dead trees with direct exposure to sunlight. The warmer temperature from sunlight exposure helps development of fetal and juvenile young (Racey 1982). A maternity roost may contain 100 or more adult females and their pups.

Roost trees often provide suitable habitat as a maternity roost for only a short period of time. Roost trees are ephemeral in nature; suitable trees fall to the ground or lose important structural characteristics such as bark exfoliation (Gardner et al. 1991; Britzke et al. 2003). Dead trees retain their bark for only a certain period of time (about 2-8 years). Once all bark has fallen off a tree, it is unsuitable to the Indiana bat for roosting. Gardner et al. (1991) found that 31% of Indiana bat occupied roost sites were unavailable the summer following their discovery; 33% of the remaining occupied roost sites were unavailable by the second summer. For this reason, an area must provide a continual supply of suitable roost trees in order to support a colony over the long-term.

Female Indiana bats have shown strong site fidelity to both their summer maternity grounds and specific roost trees, and will use suitable roost trees in consecutive years, if they remain standing and have sloughing bark (Gardner et al. 1991; Callahan et al. 1997; Kurta and Murray 2002). Traditional summer areas are essential to the reproductive success of local populations. It is not known how long or how far female Indiana bats will search to find new roosting habitat if their traditional roost habitat is lost or degraded. If they are required to search for new roosting habitat, it is assumed that this effort places additional stress on pregnant females at a time when fat reserves are low or depleted and they are already stressed from the energy demands of migration.

It is unknown how many roosts are critical to the survival of a colony, but the temporary nature of the use of the roost trees dictates that several must be available in an area if the colony is to return to the same area and raise their young successfully. Indiana bats require many roost trees to fulfill their needs during the summer (Callahan et al. 1997). In Michigan, Indiana bats used two to four different roost trees during the course of one season (Kurta and Williams 1992). In Missouri, each colony used between 10-20 roost trees, and these were not widely dispersed (all within a circle ranging in size from 0.81 to 1.48 km) (Miller et al. 2002). The important factor associated with roost trees is their ability to protect individuals from the elements, and to provide thermal regulation of their environment. Maternity colonies have at least one primary roost, which is generally located in an opening or at the edge of a forest stand. Maternity colonies also use multiple alternate roosts which are located in the open or in the interior of forest stands. Exposure to sunlight is important during development of fetal and juvenile young. In Missouri, use of dead trees in the forest interior increased in response to unusually warm weather (i.e., shading provided a cooler thermal environment), and use of live trees and snags in interior forest increased during periods of precipitation (Miller et al. 2002). Maternity colonies in North Carolina and Tennessee used roosts located above the surrounding canopy (Britzke et al. 2003).

Colonies may be negatively impacted by the removal of occupied roosts during the maternity season. Roosting individuals or maternity colonies may be forced to abandon a traditionally used roosting area if other suitable roost trees are not available within their traditional home range. This would likely lead to negative physiological consequences and possibly lower annual

survival and reproductive rates for exposed individuals. This effect would be exacerbated in maternity colonies with pregnant females or females that are already expending extra energy in caring for their young. The survival rate of young bats also may decrease with forced abandonment by lactating females from occupied roosts, even if on a temporary basis. Depending on the difficulties in finding alternate habitat, additional energy expenditure may be significant, reducing their potential to obtain sufficient body mass to migrate back to their hibernacula. This could increase the possibility of death during hibernation or the following spring, a reduction in subsequent reproductive performance, abortion or absorption of embryos, or abandonment of young.

Indiana bats have been found roosting in several different species of trees, and it appears that they choose roost trees based on their structural composition. Therefore, it is difficult to determine if one particular species of tree is more important than others. However, 12 tree species have been listed in the Habitat Suitability Index Model as primary species (class 1 trees) (Rommé et al. 1995). These trees include silver maple (*Acer saccharinum*), shagbark hickory (*Carya ovata*), shellbark hickory (*C. laciniosa*), bitternut hickory (*C. cordiformis*), green ash (*Fraxinus pennsylvanica*), white ash (*F. americana*), eastern cottonwood (*Populus deltoides*), red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*) slippery elm (*Ulmus rubra*), and American elm (*Ulmus americana*). In addition to these species, sugar maple (*A. saccharum*), shingle oak (*Q. imbricaria*), and sassafras (*Sassafras albidum*) are listed as class 2 trees (Rommé et al. 1995). These tree species are favored by the Indiana bat, since as these trees age, their bark will slough.

Male Roosting Habitat. Some adult males use mature forests around and near their hibernacula for roosting and foraging from spring through fall. Others have been found migrating far from their hibernacula area (Hobson and Holland 1995). Male Indiana bats also exhibit summer habitat philopatry.

Roosting habitat for male Indiana bats appears similar to female bats, and males and females have been caught using the same general area (e.g., Fishhook Creek, Illinois, Gardner et al. 1991). However, there are often notable gender differences in roost tree size and the juxtapositioning of roosting and foraging areas. Male Indiana bats have been found roosting in trees as small as 6.4 cm (2.5 inch) dbh (Gumbert 2001), although the average diameters reported in literature are much larger: 38.1 cm in Indiana (n=14, Brack et al. 2004) and 28.6 cm in Kentucky (n=41, Gumbert 2001). As male bats roost solitarily or in small groups, the size of the roost tree in terms of its available roosting space, is not likely a limiting factor. Male bats must thermoregulate, thus roost tree size and other characteristics affecting the microclimate of the roost site are still germane. The connectivity between roosting and foraging sites may not be as critical for males as it is for maternity colonies because the latter must have prey close to their roost trees for nursing females and newly volant bats.

As previously described regarding maternity colonies, males may also be negatively impacted by the removal of roosts in the summer.

Foraging. Indiana bats feed exclusively on flying aquatic and terrestrial insects. Although there are no consistent trends, diet appears to vary across their range, as well as seasonally and with age, sex and reproductive-status (Murray and Kurta 2002; Belwood 1979). Murray and Kurta (2002) found that diet is somewhat flexible across the range and that prey consumed is potentially affected by regional and local differences in bat assemblages and/or availability of foraging habitats and prey. For example, Murray and Kurta (2002) found that adult aquatic insects (Trichoptera and Diptera) made up 25-81% of Indiana bat diets in northern Indiana and Michigan, respectively. However, in the southern part of the species range terrestrial insects (Lepidoptera) were the most abundant prey items (as high as 85%) (Brack and LaVal 1985; LaVal and LaVal 1980; Belwood 1979). Kiser and Elliot (1996) found that Lepidopterans (moths), Coleopterans (beetles), Dipterans (true flies) and Homopterans (leafhoppers) accounted for the majority of prey items (87.9% and 93.5% combined for 1994 and 1995, respectively) consumed by male Indiana bats in their study in Kentucky. Diptera, Trichoptera, Lepidoptera, and Coleopterans also comprised the main prey of Indiana bats in Michigan (Murray and Kurta 2002), however, Hymenopterans (alate ants) were also taken when abundant.

The function of foraging habitat is to provide a source of food, but it also provides night roosts for resting and digesting meals between forays and shelter from predators. The few studies conducted to date indicate that (1) Indiana bats appear to be solitary foragers (2) individuals establish several foraging areas, likely in response to varying insect densities, and (3) individuals are faithful to their foraging areas (Kiser and Elliot 1996, Murray and Kurta 2004). Foraging areas may or may not overlap with day or night roosting areas, but individual foraging ranges commonly overlap (Menzel et al. 2001). Indiana bats generally prefer foraging in wooded areas (LaVal et al. 1976, Brack 1983, Gardner et al. 1991, Butchkoski and Hassinger 2002, and Murray and Kurta 2002), and are frequently associated with streams, floodplain forests, forested wetlands, and impounded water bodies (Garner and Gardner 1992, Murray and Kurta 2002). Woody vegetation with a width of at least 100 ft (30 m) on both sides of a stream has been characterized as excellent foraging habitat (Cope et al. 1974). Indiana bats forage and fly within air space from 6 to 100 ft (2-30 m) above ground level (Humphrey et al. 1977), typically in and around tree canopy and in openings (Humphrey et al. 1977, LaVal et al. 1976, Brack 1983, Gardner and Gardner 1992, Gardner et al. 1996, Murray 1999).

Indiana bats will forage in small openings, but generally appear to avoid foraging over large open expanses and prefer forested areas (Humphrey et al. 1977, Brack 1983, Brack & LaVal 1985, Gardner and Gardner 1992, Murray and Kurta 2004). In Michigan, Murray and Kurta (2004) found that Indiana bats used wooded corridors for traveling and foraging, even when this required them to significantly increase their nightly commuting distance.

Another important aspect of Indiana bat habitat is mid-story cover. It is important to discuss forest clutter for two reasons. First, when foraging in clutter, bats must detect targets amid the echoes from non-target objects (Fenton 1990). The greater the density of non-target items the more noise bats must decipher. Second, the greater the physical and acoustical clutter, the more difficult it is for Indiana bats to maneuver to avoid collisions. Indiana bats navigate and forage on the wing. Foraging in less spatially complex habitats is likely to be less energetically expensive. Hence, it is acknowledged that a relatively open mid-story (<40% of trees are 2-4.7

in (5-12 cm) dbh) (Rommé et al. 1995) is an important feature of high quality Indiana bat foraging habitat.

Connectivity of the foraging area to the roosting area is also an important feature. Murray and Kurta (2002) suggested that within a home area, bats appear to be faithful to their travel corridors as they observed Indiana bats using the same corridors for more than 5 years. There have been reports of bats traveling through relatively open areas (e.g., bats documented crossing over or under bridges on I-70 in Indiana) to reach foraging habitat (Butchkoski and Hassinger 2002). As explained previously it is unknown whether bats in these instances are specifically choosing to use the open areas or whether they have no other option. For lactating females and newly volant pups, the distance between foraging and roosting sites should be minimized to the extent possible. Murray and Kurta (2004) found that lactating females returned 2-4 times/night to their day roosts, presumably to nurse their young, while non-lactating females did not return to their day roosts. Barclay (1991) and MacGregor (1999) have found that female bats chose roost sites based on high insect abundance in the area (along with other roost suitability criteria), so that foraging doesn't come at too high an energetic cost.

The maximum distance that Indiana bats will travel to forage is unknown and studies have revealed a considerable range of movement capabilities. Foraging distances reported range between 1 and 7.8 km for females and 1 and 3 km for males (Gardner et al. 1991, Garner and Gardner 1992; Kiser and Elliot 1996). This great variability likely reflects differences in habitat quality and/or prey availability. Although the ideal configuration of a colony's or individual bat's home-range is unknown, it is reasonable to assume the closer the essential habitat elements are located, the better. Contiguous habitat elements reduce the travel time between foraging and day roosting areas, which will decrease exposure time to predation and reduce energetic costs of foraging.

Fall Swarming and Mating. From late-August to mid-October, prior to entering the hibernacula, large numbers of Indiana bats fly in and out of cave or mine openings from dusk till dawn in a behavior called swarming. Swarming usually lasts for several weeks and mating occurs toward the end of this period. Male Indiana bats tend to be active for a longer period of time than females during swarming and will enter the hibernacula later than the females (LaVal and LaVal 1980). Adult females store sperm through the winter thus delaying fertilization until early May.

Threats

The causes for the population decline of the Indiana bat have not yet been definitively determined. However, the documented and suspected reasons for decline include disturbance and vandalism; improper cave gates and structures; natural hazards; microclimate changes; adverse land use practices; and chemical contamination.

Human disturbance of hibernating bats led to a decline in Indiana bat populations from the 1960s to the 1980s (USFWS 1999). Disturbance from recreational cavers and researchers entering hibernacula can cause bats to expend crucial fat reserves before they are able to forage in the spring. If disturbance occurs too often, fat reserves can be depleted before the species can begin foraging in the spring.

Changes in the microclimate of a cave or mine can affect temperature and moisture level, thereby affecting suitability of the hibernaculum or affecting bat physiology (Richter et al. 1993; Tuttle and Kennedy 2002). Blockage or modification of entry points can alter airflow in a cave or mine. This poses serious consequences when a hibernaculum is on the warm edge of the species hibernating tolerance, or has less stable temperatures. In northern areas, changes in airflow could lead to areas of the mine or cave being too cold for the bat. In either case, changes in airflow and the microclimate could result in individuals having to use less optimal locations in the hibernaculum. This could leave them vulnerable to predation, freezing, or exhaustion of fat reserves. Improper gates have either rendered hibernacula unavailable to the Indiana bat, or have altered air flow causing hibernacula temperatures to be too high for bats to retain fat reserves through the winter (Richter et al. 1993). Cave entrances essential to proper cooling of key hibernating sites must be identified and protected from inadvertent closures, including those that may occur naturally (Tuttle and Kennedy 2002).

Land use practices, fire suppression, and agricultural development have reduced available roosting and foraging habitat as well as reduced the abundance of insects for bat prey across its range. Ongoing research and monitoring is helping to enhance the understanding of habitat use and characteristics. When done properly, experts consider forestry practices to be compatible with Indiana bat conservation; however silvicultural methods need to maintain structural features important for roosting and foraging

Bioaccumulation of environmental contaminants is suspected as a potential factor in the decline of the Indiana bat. Organochlorine insecticides became widely used after World War II; they are neurotoxic, synthetic chemicals of which many are resistant to metabolism in mammals (O'Shea and Clark 2002). Organochlorine insecticides may have resulted in chronic mortality of Indiana bats (O'Shea and Clark 2002). For example, guano collected from an Indiana bat roost in Indiana in the 1970s had concentrations of dieldrin in their guano comparable to the levels found in colonies of gray bats that suffered mortality from dieldrin poisoning (O'Shea and Clark 2002). Schmidt et al. (2002) measured levels of Polycyclic Aromatic Hydrocarbons and organochlorine pesticides in surrogate bat species to ascertain potential effects to the Indiana bat. At low concentrations, these chemicals cause cancer and cellular mutations in mammals, and may affect reproductive success by reducing viability of gametes or offspring.

Previous Range-Wide Incidental Take Authorizations

All previously issued Service biological opinions involving the Indiana bat have been non-jeopardy. These formal consultations have involved (a) the Forest Service for activities implemented under various Land and Resource Management Plans on National Forests in the eastern United States (b) the Federal Highway Administration for various transportation projects, (c) the U.S. Army Corps of Engineers (Corps) for various water-related projects, and (d) the Department of Defense for operations at several different military installations. Additionally, an incidental take permit has been issued under section 10 of the Endangered Species Act to an Interagency Taskforce for expansion and related development at the Indianapolis Airport in conjunction with the implementation of a Habitat Conservation Plan.

It is important to note that in many of these consultations, survey information was lacking. As Federal agencies are not required to conduct surveys, often the Service relied on a host of valid factors in helping the Federal agency determine whether Indiana bats may be present. To ensure the Federal agency and the Service met the mandate of the section 7(a)(2), if the best available data indicated that Indiana bats may be present, the assumption was made that a maternity colony (in most instances) occurred within the action area. Although this approach, we believe, fully accords with the intent of Congress and the Endangered Species Act of 1973, it likely resulted in an over-estimate of the number of individuals or colonies that may have been impacted by Federal actions.

National Forests- Within the past several years, nearly all National Forests within the range of the Indiana bat have requested formal consultation at the programmatic level. Consultation under Section 7 of the Act is necessary to ensure agency actions do not jeopardize the continued existence of listed species. These consultations have led to non-jeopardy biological opinions with associated incidental take statements. Although some of these incidental take statements anticipated the take of reproductive females, we have not yet confirmed the loss of a maternity colony on a National Forest. The reasons for this are likely two-fold. First, the conservation measures (i.e., standard and guidelines) and the project-specific reasonable and prudent measures were designed to minimize maternity colony exposure to the environmental impacts of Forest Plan actions. Specifically, these measures ensured an abundance of suitable Indiana bat habitat on the National Forests, and protected all known or newly discovered maternity colonies.

Other Federal Agencies or Non-federal Entities- Several incidental take statements have been issued to other Federal agencies. Unlike those issued for the National Forest Land and Resource Management Plans, some of these projects were certain to impact known occupied habitat. To minimize the effect of these projects, the action agencies agreed to implement various conservation measures. These included: seasonal clearing restrictions to avoid disturbing female Indiana bats and young; protection of all known primary and alternate roost trees with appropriate buffers; retention of adequate roosting and foraging habitat to sustain the maternity colony into the future; and permanent protection of areas and habitat enhancement or creation measures to provide future roosting and foraging habitat opportunities.

With the exception of three (Fort Knox, Great Smoky Mountains National Park, and Laxare East and Black Contour Coal Mining projects), none of these biological opinions and associated incidental take statements anticipated the loss of a maternity colony. Required monitoring for 3 of these consultations (Camp Atterbury, Newport Military Installation, and Indianapolis Airport) has confirmed that the affected colonies persisted through the life of the project and continue to exist today. We recognize that given the philopatric nature of Indiana bats and the long life-span, the full extent of the anticipated impacts may not yet have occurred. Nonetheless, these monitoring results and the lack of data to suggest otherwise for the other projects, indicate that the conservation measures to avoid and minimize the impacts of Federal projects appear to be effective. Only with long-term monitoring will we definitively be able to determine the true effectiveness of our conservation measures.

In summary, we believe the take exempted to date via section 7 consultation has resulted in short-term effects to Indiana bat habitat and, in limited circumstances, on Indiana bat maternity

colonies. As many of these consultations necessarily made assumptions about Indiana bat presence, we are confident that the number of maternity colonies actually exposed to the environmental impacts of the Federal actions is far less than we have anticipated. Furthermore, although not definitive, monitoring of several maternity colonies pre- and post-project implementation preliminarily suggests that our standard conservation measures, appear to be effective in minimizing adverse effects on maternity colonies.

Range-wide Status and Distribution of the Species

The Indiana bat was listed as an endangered species on March 11, 1967 (32 FR 4001) under the Endangered Species Preservation Act of October 15, 1966 [80 Stat. 926; 16 U. S. C. 668aa(c)]. Critical Habitat was designated for the Indiana bat on September 24, 1976 (41 FR 41914); 11 caves and two mines in six states were listed as critical habitat: Illinois - Blackball Mine (LaSalle Co.); Indiana - Big Wyandotte Cave (Crawford Co.), Ray's Cave (Greene Co.); Kentucky - Bat Cave (Carter Co.), Coach Cave (Edmonson Co.); Missouri - Cave 021 (Crawford Co.), Caves 009 and 017 (Franklin Co.), Pilot Knob Mine (Iron Co.), Bat Cave (Shannon Co.), Cave 029 (Washington Co.); Tennessee - White Oak Blowhole Cave (Blount Co.); and West Virginia - Hellhole Cave (Pendleton Co.).

Historically and currently, the Indiana bat geographic range encompasses 27 states, with the majority of records from the Midwest. Although there is no administrative record, it is believed that the species was listed because of observed declines in numbers. The data regarding Indiana bat abundance prior to Federal listing are limited, but the information suggests that they were once far more abundant than they were in the 1960s. Tuttle and colleagues, for example, believe the overall abundance of Indiana bats likely rivaled that of the now extinct passenger pigeon (Tuttle et al. 2004). The basis for Tuttle's and others estimates of millions of Indiana bats prior to European settlement is primarily based on historic accounts, extensive staining left on the ceilings of several historic hibernacula, and other paleontological evidence. There is also other evidence indicating that Indiana bat numbers were once much higher. Based on a deposit of bones, it is estimated that a minimum of 300,000 Indiana bats were killed by a flood in Bat Cave, Edmonson County, Kentucky in 1937 (Hall 1962). Although we are never likely to know the true historical abundance of Indiana bats, it seems clear from the evidence above that Indiana bats were much more abundant than observed in 1960.

Hibernacula counts at a sample of known hibernacula began in 1960 and were repeated at approximately 10-year intervals. Beginning in the early 1980s, biennial counts at several known hibernacula were conducted, and in 2001, a concerted effort to track numbers at all known and accessible Priority 1 and 2 and most of Priority 3 hibernacula began. In 2002, the recovery team leader, using these data and host of assumptions (e.g., similar methodologies over time and among hibernacula, using current densities to estimate past numbers at newly found caves, assuming unchanged densities at hibernacula no longer accessible, etc.) compiled population estimates at 10-year intervals. Despite the many limitations associated with the dataset, Clawson's (2002) compilation shows a marked decline in estimated numbers over time. Estimated Indiana bat numbers declined each decade since 1960: ~883,300 Indiana bats in 1960/1970; 678,700 in 1980; 473,500 in 1990; and 382,300 in 2000/2001. Upon further analysis, Clawson found that the decline was not evenly distributed across the winter range. The

population in the southern portion of the range decreased an estimated 80% in the 40 years from 1960 to 2001, with the largest declines observed in Kentucky and Missouri hibernacula. In contrast, the population in the northern Midwest and Northeast increased by 30%. Clawson also indicated that the last estimated inter-decadal hibernation count suggests that the rate of decline has slowed. From 1960/1970 to 1980, the estimated population numbers decreased by 23 percent; from 1980 to 1990 by 30 percent; and from 1990 to 2001 by 19 percent.

The results from the 2001 to 2005 biennial counts suggest that at least for this 5-year period, the extreme decreases observed in each previous decade may not occur this decade. From 2001 to 2003 and 2003 to 2005, increases (4.2% and 16.7%, respectively) in the estimated numbers were observed. These are the first calculated increases in the range-wide population estimate since the Indiana bat was listed and monitoring began. Although the observed increases are encouraging, we are uncertain of what the future population trend will be and vulnerability of the current population.

The Service has completed an agency draft revised recovery plan for the Indiana bat (USFWS 1999). The recovery actions identified in the draft revised plan are:

1. Conduct research necessary for the survival and recovery of the Indiana bat, including studies on ecology and life history; summer habitat requirements; genetics; potential chemical contamination; and assessments of temperature profiles and hibernation microclimates of major hibernacula.
2. Obtain information on population distribution, status, and trends.
3. Protect and maintain Indiana bat populations.
4. Provide information and technical assistance outreach.
5. Coordinate and implement the conservation and recovery of the Indiana bat.

According to this draft plan, if recovery criteria are adequately met, reclassification of the Indiana bat to threatened would be considered in 2005 and delisting would be considered in 2011. However, this plan is currently undergoing another revision process. During this process, significant portions of the draft plan are likely to change, including the recovery actions and recovery criteria. This final plan is expected to be complete by June 2006.

Environmental Baseline

This section describes the species status and trend information within the action area. It also includes State, tribal, local, private actions already affecting the species or that will occur contemporaneously with the proposed action. Unrelated Federal actions that have completed formal or informal consultation are also included in the environmental baseline.

Status and Distribution of the Species in the Action Area (and in Michigan)

Based on survey and studies of bat species and historical records (Kurta 1982; Kurta et al., 1989; Kurta et al., 1993a; Kurta 2000; Tibbels and Kurta 2003), the current known distribution of the Indiana bat in Michigan is shown in Figure 3. Indiana bats have been documented in the summer almost exclusively in southern Michigan, with only one record in northern Michigan. Summer

distribution in Michigan is currently known from Cass, Calhoun, Eaton, St. Joseph, Jackson, and Lenawee counties. Historical summer records have been recorded from Emmet, Jackson, and Wayne counties. The record from Emmet County, the northern most sighting of this species in Michigan, was a male Indiana bat found under wooden shake siding on a building in early May (MacGregor, pers. comm. 2001 as cited in USFWS 1999). Available evidence indicates that most Indiana bats known to summer in Michigan, likely winter in caves in Indiana, Illinois, and Kentucky (Kurta 1982, 2002), although one hibernaculum with a small population of Indiana bats has been documented hibernating in Tippy Dam in Manistee county (Figure 3).

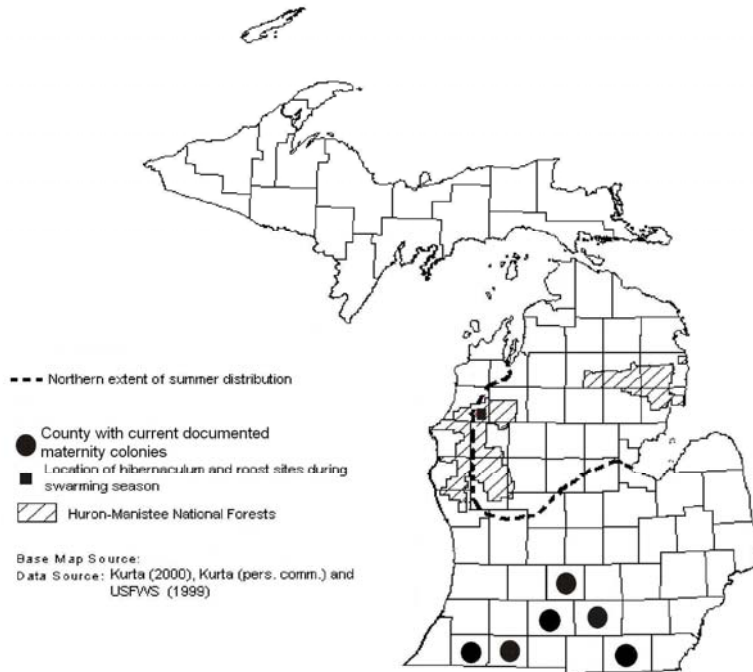


Figure 3. Potential summer distribution of the Indiana bat in Michigan.

Kurta (1992) reports that temperature is the most important environmental factor affecting biology of all bats. It affects the species' hibernation, roosting, duration of gestation and lactation, activity of insect prey, and ultimately activity patterns, of all bat species (Kurta 1992, Erickson and West 2002). Summer temperature regimes on a micro- and macro- scale likely play a key role in distribution, abundance, and reproduction of the Indiana bat (Brack et al. 2001). Cooler summer temperatures associated with latitude or elevation likely constrain reproductive success and therefore the summer distribution (Brack et al. 2002). Cave temperatures, which are typically a function of regional surface temperature, must be cold, but not too cold for hibernation (Brack et al. 2002). Thus, Indiana bats likely require a unique combination of summer warmth and winter cold to persist in an area (Brack et al. 2002).

Hargrove and Hoffman (1999) developed an ecoregion characterization using multivariate clusters, which uses multiple environmental conditions, including temperature, to produce ecoregion borders. Brack et al. (2001), using the "growing degree days" (number of days in the growing season temperature range per year) of Hargrove and Hoffman (1999), provided additional understanding of the summer range of the Indiana bat, beyond that of ecosystem- or

habitat-based models alone. The line on the Indiana bat distribution map (Figure 3) is a segregation line in growing degree-days from multivariate clustering from Hargrove and Hoffman (1999). The segregation is being used to depict a northern boundary of the potential summer range of the Indiana bat in Michigan.

Indiana bats were discovered in 1994 hibernating in Tippy Dam (Kurta and Teramino 1994), owned by Consumers Energy Company (Consumers), but located within the administrative boundary of the Forest (Manistee NF) on the Manistee River in Manistee County. The spillway of Tippy Dam shelters one of the largest populations of hibernating bats (multiple species) in Michigan, and it is the only known Indiana bat hibernaculum in the state (Kurta et al 1997). Annual counts estimated 16,000 to 20,000 bats hibernating inside the hollow concrete spillway of Tippy Dam between 1994 and 1998 (Kurta 1998; Kurta et al. 1997). Although numbers have fluctuated recently, dropping as low as 9,000 bats in February 2000 (Kurta 2000), surveys performed in 2001 to 2002 indicate that the numbers of hibernating bats has rebounded to approximately 19,000 individuals (Kurta 2002).

Most of the bats known to hibernate in the spillway of Tippy dam are little brown bats (*M. lucifugus*) and northern bats (*M. septentrionalis*); very few are Indiana bats. The exact number of Indiana bats that hibernate in the spillway is unknown, however, since the internal geometry of the dam makes it difficult to view closely and identify every bat. Since 1994, surveys have documented a total of 15 individual Indiana bats, eight females and seven males, at Tippy dam; eleven of these were caught during hibernation and four during swarming. Two new individuals were caught and banded in the 2001 - 2002 survey (Kurta 2002). Based on the survey data, the total number of Indiana bats in Tippy dam is estimated between 3 to 65 bats; the actual number, however, is most likely on the lower end of this range (Kurta et al. 1997).

Based on surveys performed from 1994 to 2002, Indiana bats are consistently present at Tippy Dam, albeit in low numbers (Kurta 2002). The existing Tippy Dam spillway appears to provide suitable temperature and humidity conditions for the bat species that hibernate there. Human disturbances during the fall and winter are rare because access to the spillway is limited and controlled by Consumers. Access to the area is further limited because most of the land surrounding Tippy Dam is owned by Consumers, the Little River Band of Odawa Tribe, and the HMNF. The habitat surrounding Tippy Dam is wooded and appears to supply adequate roosting habitat for bats during swarming. Further details on habitat management are available in the Indiana Bat Management Plan (Kurta 1995) and Manistee River Land Management Plan prepared in compliance with requirements for the Federal Energy Regulatory Commission's (FERC) relicensing the Consumers hydropower facility at Tippy Dam. The bat population, including Indiana bats, hibernating in Tippy dam is considered stable and well-protected (Kurta 2002).

No additional caves or mines exist on the Forest. The other dams on the Forest lack suitable cave-like habitat found in Tippy Dam. Because Tippy Dam is the only known hibernaculum in Michigan, autumn swarming and spring staging are likely restricted to this area. Radio-telemetry studies documented two male Indiana bats roosting in woodlands near Tippy Dam during autumn swarming season (Kurta 2000). Both roosted in a variety of trees within 2.1 mi (3.4 km)

of the dam. These are the only records of Indiana bats in the action area, outside of the Tippy Dam hibernaculum.

The potential range of the Indiana bat extends into the northwestern part of the Manistee NF, along Lake Michigan (Figure 3). This is the area where Indiana bats, if present anywhere on the Forest (Huron or Manistee NFs) in summer, would most likely be found. Although Tippy Dam itself is located just outside of this range, lands within 5 mi (8 km) of the hibernaculum are also considered within the potential range of Indiana bat. Of the potential Indiana bat range in Michigan, a total of 441,214 ac (178,554 ha) are within the action area, approximately 40 percent of which (178,214 ac; 72,121 ha) is owned by the Forest.

Indiana bats known to summer in southern Michigan must migrate from hibernacula to the south in Indiana, Ohio, and Kentucky, or from Tippy Dam to the north. Indiana bats banded during summer in southern Michigan have not been documented hibernating in Tippy Dam, however, they have been recovered in hibernacula in Indiana and Kentucky, providing evidence that migration to the south has taken place (Kurta and Murray 2002). Migration between the summer range and hibernacula either to the north or the south could include much of HMNF during spring and autumn. Migratory habitat could include essentially all types of woodlands, bridges, buildings, and other structures.

To date, Indiana bats have not been found during summer on the Forest and the summer range for the Indiana bats hibernating at Tippy Dam is unknown (Kurta and Rice 2002). The closest known summer maternity record for the Indiana bat is near Vermontville, Michigan (Eaton Co.), approximately 62 mi (100 km) southeast of the Manistee NF, and about 130 mi (209 km) southeast of Tippy Dam. There are no historic records for the Indiana bat on the HMNF (Kurta 1982). Surveys performed in central Michigan, including HMNF lands, in 1986 found no Indiana bats (Kurta et al. 1989). Summer mist net surveys conducted at 27 sites on suitable habitat in the Manistee portion of the HMNF in 1998 and 1999 also found no Indiana bats (Kurta 2000). Recently, Tibbels and Kurta (2003) performed ultrasonic monitoring and mist net surveys in red pine stands on the Forest found no Indiana bats. The authors believe that red pine stands have low insect abundance and are too structurally complex to be suitable habitat for bats.

The negative results of these surveys, however, do not provide conclusive evidence that Indiana bats do not summer on the Forest. It is possible that small, isolated colonies were missed (Kurta 2000). Given the small numbers of Indiana bats known to hibernate in Tippy Dam, the probability of detecting them on the Forest in the summer is very low because of the large area of available habitat.

Male Indiana bats may remain geographically close to the hibernacula during summer (LaVal and LaVal 1980; Brack 1983; Whitaker and Brack 2001; Gumbert 2001). During this time, males often roost individually, and likely use trees similar in character to those used near hibernacula in autumn and spring. They sometimes visit the hibernacula during summer. Thus, it is possible that male Indiana bats may summer on the Forest, likely near Tippy Dam (Kurta 2000).

It is likely that small isolated maternity colonies and scattered individual male and non-reproductive female Indiana bats are present on the Manistee NF during summer, and have not yet been detected (Kurta 2000). Restrictive climatological conditions, however, similar to those known to limit Indiana bat reproduction elsewhere in its range, are present. Most of the Manistee NF, extends above 43° north latitude. The line delineating the potential northern extent of the Indiana bat range, derived from growing degree days, corresponds with the delineation of mean annual temperatures of 45°F. Thus, the potential Indiana bat range on the Manistee NF is consistent with the known northern limits of distribution in other portions of Indiana bat range and has similar climatological conditions that are sub-optimal for Indiana bat reproduction (Clark et al. 1987; Hobson 1993; Cryan et al 2000; Brack et al 2001; Kiser et al. 2001a and 2001b; Brack et al. 2002). Based on the low numbers of hibernating individuals and the apparent reproductive constraints imposed by local climate, it is unlikely that the Indiana bats from Tippy Dam, or from anywhere else in the species' range, summer or reproduce in significant numbers on the Forest.

Factors Affecting The Species Environment Within The Action Area

The Forest Plan for the Forest was first implemented in 1986 and underwent formal section 7 consultation. The Indiana bat was not known to be present on the Forest at that time and thus was not included in the consultation. Furthermore, the standards and guidelines for timber harvest included in the Plan provided no special protection or consideration for the Indiana bat or its habitat. Although bat surveys performed in 1989 found no Indiana bats on the Forest (Kurta et al. 1989), Indiana bats may have been present, but only in undetectable numbers. Because of this, adverse effects to this species may have occurred. Specifically, harvest in suitable Indiana bat habitat may have resulted in degradation of roosting habitat or loss of roosting individuals in felled trees.

Since the discovery of Indiana bats in Tippy Dam in 1994, both the FERC and the Forest have consulted with the Service on actions that may affect the Indiana bat. Consultation with the HMNF occurred with the assumption that the Indiana bat was present where suitable habitat existed. Consultation occurred throughout the HMNF, and this assumption did not apply the climatic variables that are now used to define the species potential range on the HMNF (although the potential for these climatic restrictions were discussed in project-specific biological assessments). The outcome of these informal consultations was “not likely to adversely affect.” This determination was reached by either avoiding stands with suitable Indiana bat habitat, or by incorporation of a variety of conservation measures including:

- Seasonal harvest prohibition in potential Indiana bat habitat between May 1 and August 31.
- Seasonal harvest prohibition in the Tippy Management Zone between May 1 and October 20.
- Prohibition of prescribed burns in the Tippy Management Zone between May 1 and October 20.
- Where timber harvest occurs in potential Indiana bat habitat, an average of 4 suitable roost trees per acre are maintained.
- Regeneration units designed with irregular borders to provide edges for solar exposure of roost trees, interspersed of roosting and foraging habitats, and travel corridors.

- Removal of standing dead trees for firewood cutting prohibited in potential Indiana bat habitat between May 1 and August 31.

We believe that the use of these conservation and avoidance measures in each individual project has cumulatively, for all projects, maintained or improved the status of this species in the action area by reducing the possibility of take of an Indiana bat, maintaining or increasing the long-term number of available suitable roost trees, and improving potential roosting habitat on the Manistee NF.

The Forest Plans was amended in 2003 to consider impacts to listed species not considered in the 1986 Plan. This amendment included many conservation measures designed to maintain and protect Indiana bat habitat and minimize adverse impacts to the species. These measures were as follows:

<p>Where vegetation management occurs, an average of 9 suitable roost trees (≥ 9 in [23 cm] dbh) per acre will be maintained within the treated acres where available by the following priorities:</p> <ul style="list-style-type: none"> -High quality summer roost trees (snags) regardless of species, prioritized by the following size classes: <ul style="list-style-type: none"> - 16 in (41 cm) dbh or greater. - 9 to 16 in (23 to 41 cm) dbh. - 3 to 9 in (8 to 23 cm) dbh. - Retain as many standing snags >3 in (8 cm) dbh as practical (a minimum of 9) within regeneration and timber management units: <ul style="list-style-type: none"> - Give preference to larger snags; retain all snags ≥ 16 in (41 cm) dbh. - Snags should be retained regardless of species. - Assure that care is taken during site preparation, seeding, etc., to avoid damage or loss of retained snags. - Standing live trees >3 in (8 cm) dbh with >25 percent exfoliating bark, regardless of species. - Retain hollow, den, and cavity trees >9 in (23 cm) dbh as practical, regardless of species. - Retain shagbark and bitternut hickories, regardless of size, and regardless of whether dead or alive. - When few snags are available or cannot be left, leave at least 9 of the largest live trees on site (preferably ≥ 26 in [66 cm] dbh) in the Class I Category. - Retain live trees around larger snags (>16 in [41 cm] dbh) to provide protection from wind throw; give preference to retaining oaks and hickories; if individual trees are health or safety concerns, consider grouping them or protect zones around them. - Leave seed trees uncut in seed-tree harvest areas, particularly in areas of oaks and hickories; retain the largest trees as seed trees in order to ensure a component of large, over-mature trees. - In individual and group selection harvests: <ul style="list-style-type: none"> - Ensure that a component of large, over-mature trees remain to provide suitable roosting habitat – retaining at least 3 live trees per acre >20 in (51 cm) dbh; these must be among the largest trees available in the stand. - If there are no trees >20 in (51 cm) dbh, retain 16 of the largest available trees per acre. - When available, trees left should be Class I type trees, (oaks and hickories; other desirable species include eastern cottonwood, green and white ash, and American and slippery elm).
<p>Regeneration units will be designed with irregular borders to provide edges for solar exposure of roost sites, interspersion of roosting and foraging habitat, and travel corridors.</p>
<p>Survey and document pre- and post-harvest roost tree conditions, including inventory and protection measures.</p>
<p>Prohibit removal of standing dead trees for firewood between May 1 and August 31. Annually update the firewood cutting maps to identify areas that are off limits.</p>

Generally, prescribed burns are prohibited between May 1 and August 31. Prescribed burns in the Tippy Management Zone (5-mi [8-km] radius around Tippy Dam) are prohibited between May 1 and October 20.
Protection zones will be established around maternity colonies as discovered.
Create or renovate upland water sources for Indiana bat by: <ul style="list-style-type: none"> - Developing water holes in wildlife openings along the forest edge. - Designating Maintenance Level 1 and decommissioned roads to provide upland water sources. - Designing road construction and reconstruction projects to include small waterholes adjacent to the road, where feasible.
Manage the 5-mi (8-km) radius around Tippy Dam to best benefit the bat.
Habitat removal and modification include considerations for minimizing potential adverse impacts, such as visual assessments of roosting habitat quality (exfoliating bark, splits/cracks, hollows, holes, dens, and cavities) or other assessment techniques such as mist-netting
Habitat removal and modifications will employ seasonal avoidance measures as feasible and prudent
Site-specific project protection measures will be developed during biological evaluations to identify appropriate protection measures.
Monitoring for Indiana bat and habitat: <ul style="list-style-type: none"> - Monitor the presence of Indiana bats at the Tippy Dam hibernaculum during fall swarming and winter surveys in cooperation with Consumers Energy on a five-year frequency interval. - Monitor presence of Indiana bats during the summer period on the Manistee National Forest suitable habitat area using Service-approved protocols on a three-year frequency interval.
As appropriate, conduct periodic Indiana bat studies such as: summer surveys in the western half of the Manistee National Forest and autumn swarming/spring staging surveys in the area near Tippy Dam.

In June of 2003, the Service issued a final biological opinion indicating that the Plan as amended, including the above conservation measures, was not likely to jeopardize the Indiana bat. The accompanying incidental take statement anticipated take of potentially all Indiana bats on the Forest, using the best estimate of up to 65 individuals present. Under the previous standards and guidelines, we believed that no measures were in place that would have prevented the take of maternity colonies, and thus all 65 bats could be taken. However, Forest Service monitoring indicates that none of this incidental take occurred.

Tippy Dam Indiana Bat Management Plan

In response to Article 412 of the FERC's relicensing order of July 15, 1994 for Tippy Dam, a management plan for the Indiana bat at Tippy Dam was developed (Kurta 1995). The Indiana Bat Management Plan represents Part V of the Manistee River Land Management Plan for Tippy Dam (FERC Project No. 2580) that was filed with FERC on January 16, 1996. The plan for the bat addresses two threats to the species at Tippy Dam: 1) disturbance to hibernating bats and 2) destruction/degradation of nonhibernating bat habitat.

Disturbance during hibernation is a major threat to any species of hibernating bat. Consequently, to prevent disturbance to hibernating Indiana bats, the plan prohibits unnecessary entry into the spillway between September 1st and June 1st of each year. The plan also prohibits unnecessary operation of the spill gates during the same period. Operation of the gates causes a large amount of water to enter the interior of the spillway through the lower ventilation openings, resulting in a significant increase in noise levels and presumably a sudden change in air temperature and humidity, as well as an increase in air currents.

To protect any Indiana bats that may roost outside the spillway during the summer and swarming seasons, the plan prohibits tree-cutting on Consumers Tippy Project land within a 3.1 mi (5 km) radius around Tippy Dam, from May 1 through October 1 of each year. Use of pesticides is prohibited during this same period to prevent effects on the bats and their food supply (insects). In addition, the plan mandates the preservation of a suitable density of potential roost trees (>4 trees per acre) on forested portions of Consumers Tippy Project land.

The plan also calls for monitoring population trends and environmental parameters to establish baseline conditions. Monitoring both population levels and environmental parameters during the hibernation season immediately following the spillway rehabilitation work was initiated to assess potential long-term effects on all bats within the spillway. Monitoring of population levels began in February 1995, and temperature and humidity recordings were started in August 1995. Both were set to continue through the 1999-2000 season when the need for continued monitoring was to be assessed. Monitoring was continued for two more seasons through the 2001-2002.

Based on the apparent stability of the bat population (including Indiana bats) and the consistent environmental and protective conditions present at the site (Kurta 2002), Consumers believed that it had fulfilled the requirements set forth in the plan, and would no longer fund monitoring of the bat population in Tippy Dam (Hittle *in litt.*). They are amenable, however, to allow others to continue the effort and options to continue monitoring of the Indiana bats in Tippy Dam are being explored.

The Indiana Bat Management Plan has, and continues to provide, critical management and protection for Indiana bats and the Tippy Dam hibernacula, and has improved the status of the species and its habitat within the action area.

Spillway Rehabilitation Project at Tippy Dam, 1997

A comprehensive investigation was performed in 1993 to evaluate the structural condition of all hydroelectric plants owned by Consumers, including Tippy Dam. The investigation at Tippy Dam revealed extensive deterioration of exposed concrete, resulting from freeze-thaw cycles. The damage posed no immediate threat, but repairs were deemed necessary to extend the useful life of the dam. Consequently, after consulting with the FERC, Tippy Dam was scheduled for spillway rehabilitation in 1997.

On July 2, 1996, the FERC initiated formal consultation with the Service to address potential effects of the proposed action on the Indiana bats hibernating in the dam. Rehabilitation of Tippy Dam primarily entailed 1) structural rehabilitation of the concrete spillway and concrete elements of the powerhouse tailrace, 2) addition of ballast to the spillway interior to enhance long-term sliding stability, and 3) construction of a temporary cofferdam, including any necessary auxiliary structures to operate and maintain the spill capacity of the plant, during the rehabilitation period.

Along with the proposed action, multiple conservation measures for Indiana bats were proposed, including:

- Completion of the projects between May and September to avoid direct impacts to swarming and hibernating bats
- Maintenance or improvement of potential bat roosting cavities within the dam structure
- Maintenance of appropriate ventilation in the dam
- Continued implementation of the Indiana Bat Management Plan

In a January 8, 1997 biological opinion, we analyzed the potential effects of this project and determined that rehabilitation of the Tippy Dam spillway was not likely to jeopardize the continued existence of the Indiana bat. We estimated that unavoidable construction delays may eliminate or reduce suitable habitat for hibernating bats at Tippy Dam during the fall and winter of 1997-98. Because there were no known suitable substitute hibernacula nearby, this could have resulted in the incidental take of all Indiana bats that utilize the dam. Thus, based on population estimates, incidental take was permitted for 3-65 Indiana bats. No authorized or unauthorized take of Indiana bats, however, was documented as a result of this project and the physical suitability of the dam as a bat hibernaculum was maintained.

Emerald Ash Borer (Agrilus planipennis Fairmaire)

Emerald ash borer (EAB) is an exotic beetle that was discovered in southeastern Michigan near Detroit in the summer of 2002. This pest likely arrived in the United States on solid wood packing material carried in cargo ships or airplanes originating in its native Asia (APHIS 2005). While the adult beetles consume ash foliage and cause little damage, the larvae feed on phloem and outer sapwood, eating pathways that eventually girdle and kill branches and entire trees (APHIS 2005). The only known hosts of EAB in North America are ash trees (*Fraxinus* spp.) including black, green, and white ash.

Since its discovery, the EAB has spread to sites throughout Michigan's lower peninsula, including a few locations on the Forest. The EAB has also become established in Ohio, Indiana, and Windsor, Ontario. The potential path of expansion of the EAB infestation is through Ohio and Indiana into the hardwood forests of Pennsylvania and the Northeast, into the Appalachian Mountain States and the rest of the Southeast through Kentucky and West Virginia, and westward into Illinois, Wisconsin, and beyond. In addition, the spread of EAB through Canada could also infest New York and New England (APHIS 2005). Thus, EAB poses an considerable threat to the urban and rural forests of the North America.

The Animal and Plant Health Inspection Service (APHIS), along with State, and city cooperators in Michigan, Ohio, Indiana, initiated a program for control and eradication of EAB in 2002 (APHIS 2005). Efforts so far have included imposing quarantines, conducting surveys around confirmed infested sites, removing ash trees, and developing information which will support management efforts. However, lack of effective survey and control technology, other than complete tree removal, has made eradication efforts challenging.

The EAB may have significant impacts the Indiana bat in Michigan, including the Forest. In Michigan, including the Forest, there are approximately 850 million ash trees in Michigan forests at risk and ash trees comprise approximately 45% of the known Indiana bat roost trees. With control efforts in the northern portion of the Lower Peninsula of Michigan focused on reduction of the volume of ash host material (i.e., removal of infected trees), this may cause the loss of numerous future potential Indiana bat roost trees. While Indiana bats typically roost in dead trees that are not susceptible to EAB infestation, they may also roost in alive or dying trees that are susceptible and thus may be removed. In addition, control efforts, while not removing dead roosts, may indirectly disturb Indiana bats roosting in adjacent trees within the eradication area. The USFWS and APHIS have been working closely together to minimize these potential adverse impacts on Indiana bats, including infestation sites on Forest Service lands. To date, however, no known maternity colonies or individual Indiana bats have been adversely affected by EAB control activities.

It is important to note that EAB activity may also create Indiana bat roost trees. Emerald ash borer activity tends to produce dying or dead trees with sloughing bark and crown dieback (APHIS 2005), two qualities that typify suitable roosts. In addition, the dead snags that remain after infestation may continue to provide potential roosts for years. Therefore, the ultimate impact of the EAB on Indiana bats on the Forest remains unknown.

Summary and Synthesis of the Environmental Baseline

Indiana bats have been detected within the administrative boundary of the Forest, inside of Tippy Dam while hibernating and within 5 miles of Tippy Dam during autumn swarming. This small population of hibernating Indiana bats appears to be protected and stable. Indiana bats have not been detected elsewhere within the action area, and it is unknown where the Tippy Dam Indiana bats summer. The lack of summer records within the action area is consistent with other portions of the species range with similar climatic conditions. If Indiana bats are present during the summer, they likely occur in very low numbers. The species is more likely to be present near Tippy Dam, most likely during autumn and spring. Given the overall rarity of the Indiana bat on the Forest and the conservation measures that were implemented beginning in 2003 to protect this species and its potential habitat, it is unlikely that the status of the species and character of its habitat in the action area has recently decreased or is decreasing contemporaneously with this consultation.

Effects of the Action

This section assesses the effects of the proposed action, including the direct and indirect effects together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). However, we are aware of no actions interdependent or interrelated to the proposed action being considered in this biological opinion.

Analysis for the Effects of the Action

Effects of the Forest Plan Goals, Objectives, and Desired Conditions on the Indiana bat

The proposed Plan emphasizes habitat necessary to sustain minimum viable populations that represent existing native vertebrates throughout the Forest. Maintenance and improvement of populations of endangered, threatened, or sensitive species will continue to be a Forest priority. For the Indiana bat, the Forest will manage potential habitat for conditions that will result in a mosaic of hardwood species within stands differing in shape and size, with interspersed openings, considering the appropriate mix of roosting and foraging habitat, along with travel corridors. The proposed Plan also puts significant emphasis on restoring oak barrens, which provides potential Indiana bat habitat on the Forest. The proposed Plan emphasizes management for late seral stages through natural successional processes in riparian zones, focusing on retention of trees to protect water quality. The proposed Plan directs a net reduction in the miles of roads on the Forest by emphasizing closures of roads determined to be non-essential for resource management.

The proposed Plan directs that recovery plans for listed species, including the Indiana bat, be implemented. The proposed Plan also ensures that partnerships will continue by directing cooperation and coordination with responsible government and land and resource management agencies, tribes, and partners regarding endangered, threatened, and sensitive species.

We believe that the overall goals, objectives, and desired conditions of the proposed Plan are consistent with the ecological needs of the Indiana bat. We expect that implementation of this plan will protect and manage for viable Indiana bat populations.

Effects of the specific management actions on Indiana bat

Although the overall goals of the proposed action are expected have beneficial effects for both the Indiana bat, the means by which the Forest will achieve their goals may unavoidably cause short-term adverse effects to this species. This analysis assesses the likelihood and magnitude of impacts that may result directly or indirectly from specific proposed management actions or from the long-term operation of management activities. Specifically, we assess the measurable and detectable responses of Indiana bats exposed to the proposed management actions and the environmental impacts associated with the actions, and the likelihoods of the exposure and the consequent response occurring. Effects to Indiana bat from various management activities depend on the likelihood of exposure to that activity or any associated environmental consequence and the type of Indiana bat response. Although rare, we anticipate that there will be events in which direct exposure will be unavoidable. We also anticipate that there could be many instances where at least one life stage is likely to be exposed indirectly through habitat modifications. For both direct and indirect exposure, Indiana bat responses will vary from no detectable behavioral response to potential death. The program-level analysis lacks definitive temporal and spatial information for the specific management actions. Although the standards and guidelines assist with narrowing our scope of analysis by specifying timing and habitat restrictions, our analyses are necessarily broad. Thus, we identify both the range of possible responses and the most likely responses anticipated for each management activity. Many of the

standards and guidelines significantly reduce potential exposure, thereby effectively neutralizing most potential negative responses. However, some potential for negative responses remain.

Our analysis relies on both Indiana bat-specific as well as general bat literature to make these predictions. Our analytical approach is initially consider the impacts to individual fitness (in particular, effects on individual annual and life-time survival rates and annual and life-time reproductive potential). Once we anticipate the individual fitness responses, we then look at how these individual responses effect the fitness of the population or colony in which these individuals belong. Lastly, we assess how the anticipated changes, if any, at the population or colony level may affect the fitness of the species rangewide.

In general, the environmental consequences associated with the management actions proposed include: disturbance from human presence, reduction in foraging habitat, and loss of roost trees. As indicated above, the responses of individuals exposed directly to the management action or these associated environmental consequences will vary depending on the timing and scale of the management action. The analyses below describe how each management activity is expected to affect Indiana bats. Appendix B identifies the proposed management actions and associated their project elements, the environmental impacts resulting from these project elements, and the likely responses of individuals exposed to these environmental impacts. It also describes the anticipated effects to the affected population in terms of reproduction, numbers, and distribution. These tables were intended to be read in concert with the following effects analysis section.

Based on the known status of the species in the action area, the Indiana bat is likely to be present in the action area only in very small numbers (best population estimate up to 65 Indiana bats). Given the amount of potentially suitable habitat available on the Forest [441,214 ac (178,554 ha)], the likelihood of an individual bat or colony occupying an area where a management activity is implemented and incurring impacts on the Indiana bat is very low. The large geographic area and low potential number if individuals significantly reduces the potential for Indiana bat to be exposed to these actions.

The standards and guidelines that reduce exposure and responses are described in more detail in the Proposed Action section. It is important to emphasize that this effects analysis is predicated on the fact that all standards and guidelines will be fully implemented. If not, this analysis may no longer be valid.

- Range Management

The primary components of range management are grazing, fencing, salting, and haying. These activities occur on a very limited area of the Forest and expansion is not expected in this planning period. Range activities do not cause significant noise or physical disturbance and should not directly impact potential Indiana bat roosting or adversely impact the quality of roosts, travel corridors, or foraging areas. Indiana bats have been documented foraging and roosting in grazed areas (Brack 1983, Callahan 1993). Maintaining existing grazing areas is unlikely to indirectly affect Indiana bats. Low levels of human presence do not appear to deter bats from roosting, as evidenced by Indiana bats roosting in picnic areas and campgrounds. Furthermore, we do not expect that the presence of livestock will cause measurable disturbance

of Indiana bats. Trees on the edges of grazed areas may be suitable for Indiana bat roosting because they receive more solar exposure. As explained in the Status of Species section of this document, providing roosting sites with a diversity of solar exposure will provide a range of suitable roost opportunities for bats. This may improve the fitness of adults and young by improving their thermoregulatory abilities and thereby avoiding delays in post- and pre-natal development. Therefore, we expect that effects of range management to be neutral or beneficial.

- Recreation Management

The primary components of recreation management are trails (construction, operation, and maintenance) and recreational facilities (construction and operation). The Forest has an extensive recreational system and receives heavy use year round. The majority of the Forest is proposed for a Roded Natural Recreational Opportunity Spectrum (ROS), which provides conventional motorized access (cars, recreational vehicles, OHVs), developed facilities (picnic areas, parking lots, campgrounds), and a extensive trail system.

Indiana bats have been observed near picnic, park, and camping areas (Brack 1983; Kiser et al., 1998). Thus, we do not expect the noise and human activity associated with recreational facilities and trails to cause major disturbance. We expect that the Indiana bat response to this level of disturbance to be minor (e.g., startle, alarm, possible temporary abandonment of roosting site, etc.) and not likely to negatively affect their fitness. Furthermore, given the very small number of bats potentially present on the Forest, Indiana bats are unlikely to be directly exposed to these disturbances (i.e., unlikely to have a spatial co-occurrence between noise/human activity and the bat). Use of seasonal restrictions for actions that would result in habitat modification will further diminish potential for direct exposure. In addition, Indiana bats may benefit from forest trails because they minimize understory clutter and provide more efficient travel corridors. Thus, we anticipate the effects of direct exposure to disturbance to be discountable and the indirect effect of trail maintenance and construction to be neutral or beneficial.

Construction of additional recreational facilities is expected to occur on a very limited area of the Forest and should not impact a significant amount of Indiana bat habitat. Given the forested landscape, we do not expect that the loss of habitat associated with such facilities to negatively alter the character of the habitat for Indiana bats. Thus, we also do not anticipate any adverse fitness consequences to occur indirectly from recreational management activities.

- Transportation Management

In general, the proposed Plan will decrease the number road miles across the Forest. The proposed Plan increases the amount of semiprimitive management, which will require some road closure to more fully meet the desired road density in some areas. The proposed Plan also increases restoration activities for a variety of wildlife species and habitats, which will include some road obliteration. Some roads may also be closed to public vehicular use or may be restricted by vehicle type or season of use. Some management activities, such as timber harvesting and recreation, will continue generating road use, although most of these roads will be temporary and/or small.

Road construction and maintenance will occur throughout potential Indiana bat habitat on the Forest. Most construction, primarily for small and/or temporary roads, requires only minimal habitat removal that should not have a detectable impact on Indiana bat habitat. Furthermore, guidelines indicate that tree removal will avoid trees that are likely to provide Indiana bat roosts. For these two reasons, we expect the character, with respect to Indiana bat habitat, of the sites impacted by road construction will be maintained. Seasonal restrictions for actions that will result in habitat modification will ensure direct exposure does not occur. Moreover, given the very small number of bats potentially present on the Forest, Indiana bats would be unlikely to be exposed to many potential effects. Seasonal restrictions, coupled with the small number of bats on the Forest, make direct exposure to construction activities extremely unlikely. As approximately 90% of Forest Service roads are small (OML 1-2), maintenance activities, such as resurfacing and roadside upkeep, should be minimal. Thus, we do not expect direct exposure will be likely, but if exposed, we do expect negative fitness consequences.

Roads will be operated throughout Indiana bat habitat on the Forest. Road closure and rehabilitation could improve Indiana bat habitat by decreasing human activity and restoring forested habitat. While some studies have found that Indiana bats may be deterred from roosting near paved highways (Gardner et al. 1991), other have found that some Indiana bats may be tolerant of such roads (Callahan 1993). It seems reasonable, however, that noise and activity generated on large paved roads may be disturbing to some Indiana bats. These road types, OML 3-5, make up a relatively small proportion of the road miles on the Forest, making potential Indiana bat exposure extremely unlikely to occur. On lower standard roads, which comprise approximately 91% of the total Forest road miles, the noise and human activity is much lower. As indicated under Recreation Management, Indiana bats have been observed near picnic areas and campgrounds, where vehicle traffic is present at levels similar to low standard roads (Brack 1983; Kiser et al., 1998). In addition, Indiana bats may benefit from some low use, small width roads because they minimize understory clutter and provide more efficient travel corridors. Thus, we anticipate road operation is not likely to elicit a detectable negative fitness response.

- Watershed Management

Watershed management activities include general habitat management and stream/riparian management and restoration. In general, these activities are proposed to improve the condition of aquatic habitats on the Forest. General watershed management includes application of BMPs to minimize potential impacts near aquatic habitats, such as maintaining buffer strips, restricting potential contaminants (i.e., fuel, oil) near waterbodies, and planning roads to minimize erosion. Stream and riparian habitats will be protected within the Streamside Management Zones, which will minimize disturbance and protect water quality. In addition, the Forest will continue with its stream restoration program. Overall, these activities are likely to benefit the Indiana bat by maintaining and improving aquatic foraging sites. Proposed restoration of large woody debris in stream channels, along with stream bank stabilization, gravel and cobble placement for spawning habitat, and fine sediment removal, will improve the health of aquatic habitats on the Forest. Improvement of aquatic habitats should increase the Indiana bat's prey base. Furthermore, emphasis of old-growth characteristics in more riparian zones should facilitate development of roosting sites. We expect that guidelines will require the use of seasonal operation restrictions

and visual assessments to detect and avoid potential Indiana bat roosts which will make potential direct effects extremely unlikely to occur.

The Forest will also continue to cooperate with FERC on operation of the ten major hydroelectric facilities within the Forest boundaries. This includes Tippy Dam, which provides the hibernaculum for Indiana bats on the Forest. These facilities impact stream habitats through fragmentation and replacement of sections of lotic habitat with lentic impoundments. Stream fragmentation may actually protect Indiana bats from ingesting prey contaminated by restricting fish movement upstream from the Great Lakes. In addition, while wooded stream habitat may provide the superior physical characteristics for Indiana bat foraging, the wooded periphery of the open water impoundments are expected to provide foraging opportunities for Indiana bat. We believe that any negative impact of the hydroelectric facilities on Indiana bats will be undetectable. Moreover, continued cooperation regarding the Indiana bats in Tippy Dam should help protect those individuals.

- Forest Pest Management

The Forest is affected by numerous exotic insects, plants, and other pathogens. Many of these invaders have an associated management goal ranging from immediate eradication to preventing invasion in non-infested areas. The proposed Plan includes an Integrated Pest Management approach, including mechanical, biological, and chemical means of control. The overall control of invasives on the Forest should improve the long-term native biodiversity.

Mechanical control (hand pulling, cutting, digging) will be used to combat invasive plants on the Forest. While these activities may result in increased noise, human presence, and physical disturbance, these impacts will be short-term, temporary, and very localized in nature. Most of these activities are focused on weeds (e.g., spotted knapweed) and shrubby trees (e.g., buckthorn) and their removal should not affect the character of Indiana bat habitat. Human disturbance should be minimal because these activities do not require the use of large equipment. Any potential Indiana bat response from exposure to mechanical control is expected to be minor (e.g., startle, alarm, temporary movement from roost site, etc.) and will have undetectable fitness consequences.

The only type of biological control that has been used on the Forest thus far is the release of beetles to control purple loosestrife. This method may benefit the Indiana bat by opening up wetlands that are currently clogged with purple loosestrife, and prompt the return of native plants and their associated aquatic fauna. While the proposed Plan allows for other types of biological control to be used, none are currently anticipated. We expect that biological control will be used very sparingly and effects to Indiana bats will be generally beneficial, and potential negative effects will be discountable.

Pesticides will be used very sparingly on the Forest for vegetative management, fisheries management, or to suppress insects and disease infestations when their use is cost efficient, biologically effective, and environmentally acceptable. The Forest will protect aquatic habitats and other sensitive areas by establishing untreated zones adjacent to water bodies and other sensitive areas, where necessary. The Forest will establish protection zones around any known

Indiana bat maternity colonies, protecting those known foraging areas from pesticide exposure. Colonies may be discovered as the Forest surveys for Indiana bats before engaging in summer activities in likely habitat. Given the very few number of Indiana bats potentially present on the Forest, direct exposure to pesticides is unlikely.

Overall, aggressive control of invasives on the Forest should increase biodiversity and the improve ecosystem function. Based the above information, we expect Forest Pest Management on the Forest will only result in effects on the Indiana bat that are likely to be beneficial, insignificant, or discountable.

- Wildlife, Fish, and Sensitive Plant Management

The Plan proposes a wide variety of management actions and techniques for the wildlife and plant species on the Forest. These goals, objectives, standards and guidelines may be found throughout the proposed Plan. Some measures for wildlife and plant species are specifically addressed under wildlife, fish, and sensitive plant management section, including management of wetlands and wildlife openings. In addition, this section addresses implementation of recovery plans for listed species. On the other hand, many measures in the proposed Plan that will improve habitat or otherwise benefit wildlife and plant species on the Forest are addressed by other management activities (e.g., fire and vegetation management). For instance, there are several management activities that affect white-tailed deer on the forest that are not specifically addressed under wildlife, fish, and sensitive plants. Given these distinctions, in this biological opinion, management for specific species that could affect threatened and endangered plants and animals will be most often be analyzed under wildlife, fish, and sensitive plant management.

Most wetland management activities are not expected to affect the Indiana bat. The Forest will manage wetlands as winter wildlife water sources. Since Indiana bats hibernate in the winter, they will not be exposed to this action. The Forest will also manage to provide large shallow water emergent wetlands. These wetlands may provide foraging and roosting habitat for Indiana bats. Where exposed, this action may benefit Indiana bats.

The proposed Plan also contains provisions to implement recovery plans for listed species. Currently, the recovery plan for Indiana bat is in draft status (USFWS 1999) and is undergoing substantial revision with a final plan expected in 2006. The Forest has committed to address the current draft Recovery Plan Actions as follows. Upon completion of the final recovery plan, Forest Service and the Service should re-evaluate whether the level of benefit anticipated below is still valid given the new recovery strategy for the Indiana bat.

Although there is not a specific recovery strategy developed for Indiana bat at this time, we expect that implementation of these actions will contribute positively to the overall conservation status of Indiana bat. These actions should benefit the Indiana bat by protecting and improving habitat, increasing coordination among recovery partners, improving public knowledge of Indiana bat issues, and increasing the biological knowledge for the species. We expect that Indiana bats will respond favorably to these actions.

The Forest will manage openings for wildlife habitat using tree removal and prescribed burning and occur anywhere on the Forest. Effects from prescribed burning will be discussed under the Fire Management section. Tree removal specifically for wildlife openings may result in habitat loss and cause noise/physical disturbance. Indiana bats may be directly exposed to these impacts when an action occurs at a time and place when Indiana bats are present. Potential direct effects include the removal of roost trees used by a maternity colony, individuals or small groups of males, and migrants during spring and fall migration. Loss of a primary roost tree is unlikely because the Forest will observe several guidelines that require them to avoid and preserve potential roosts and favor trees of the size, structure, and species that Indiana bats are known to frequently use. Mortality or injury can result during the felling of trees. Based on observations (Belwood 2002), we believe that volant individuals will likely escape unharmed. Non-volant pups, however, could be injured or killed if the parent cannot remove them before the tree is felled or cannot retrieve the pup in time to prevent further injury or predation once the tree is cut.

As explained in the Status of Species section, loss of roost trees, particularly a primary roost, could have substantial consequences. The proposed Plan, however, includes several standards and guidelines that greatly minimize the potential for these responses to occur. In general, activities that may affect suitable Indiana bat habitat will be performed outside of the summer season, when Indiana bats are not present. Indeed, since the discovery on Indiana bats on the Forest, the Forest has postponed the vast majority of habitat-disturbing activities in potential Indiana bat habitat to the winter season. Continuation of this practice will allow the Forest to avoid direct impacts to Indiana bats for most projects, including wildlife opening projects.

Standards and guidelines only allow summer activity in optimal Indiana bat habitat (i.e., areas most likely to harbor Indiana bats) after the area has been surveyed for Indiana bats using USFWS-approved methods. If the surveys document reproductive female Indiana bats, the Forest will postpone activities until the winter, thus avoiding direct impacts to maternity colonies. If the surveys document male or non-reproductive female Indiana bats, the project may proceed using the established standards and guidelines. Under these circumstances, project activities may cause the injury or mortality of individual male or non-reproductive females. There are no data regarding the summer habits of non-reproductive female Indiana bats. In general, we expect that non-reproductive females roost singly or in small groups, similar to males. However, it is possible that some non-reproductive females may return to their home range during the summer. Surveys that detect non-reproductive females roosting with a maternity colony should also detect reproductive females, thus indicating that a maternity colony is present. In other words, we believe that it is unlikely that surveys performed in the home range of an Indiana bat maternity colony will detect only non-reproductive females. Therefore, direct negative impacts to maternity colonies should be extremely unlikely to occur.

In addition, individuals exposed to active tree removal for wildlife openings may choose to permanently or temporarily abandon their roosting area due to the noise and overall physical human disturbance. Indiana bat response to this would vary. Individuals may be forced to expend increased energy resources when relocating to other, potentially less suitable roosting sites within or outside of their home range. They may locate suitable habitat relatively easily with minimal energetic costs. However, depending on the difficulties in finding alternate habitat,

additional energy expenditure may be significant. Depending on the duration of the increased energy demand, female reproductive potential could be affected (abortion of young, abandonment of young) and the survival of adults and pups compromised (refer to Life History section for further explanation).

However, given the forested landscape within the Indiana bat range on the Forest, we expect that affected individuals would find new habitat with relative ease, and would not suffer any detectable negative fitness consequences. Furthermore, we expect areas affected to have increased solar exposure, which will provide additional roosting opportunities for bats. Where this occurs, this may improve the overall fitness and survival of adult and young Indiana bats.

- Vegetation Management

Approximately 40% of the Forest's land area is considered suitable for timber management. Over this planning period, the Forest proposes to manage approximately 290,000 acres of these lands. Harvests will be accomplished primarily through thinning and clearcutting, in addition to shelterwood and selection harvests. The Forest also manages timber on some lands not suitable for standard timber production with the primary focus of creation and maintenance of barrens and openings. The Forest proposes to create approximately 40,000 acres of barrens and openings using timber harvest and prescribed burning. Note that these are Forest-wide numbers and not all of this acreage will occur within the range of Indiana bat and that these numbers also represent some acres that will be treated multiple times.

Appendix B details the timber management activities proposed by the Forest. Timber management activities include road construction, skid roads/log landings, even-aged harvest, uneven-aged harvest, barrens creation, salvage harvest, hazard tree removal, and firewood cutting. Potential effects of road construction are discussed under transportation management. The primary environmental consequences of the remaining actions include some level of forest removal, noise and physical habitat disturbance, decreased understory or reduced clutter, and increased solar exposure. The complete list of impacts potentially resulting from timber management activities can be found in Appendix B. The following discussion details the potential Indiana bat exposure and response to timber management activities, as outlined in Appendix B.

Indiana bats may be directly exposed to timber management when an action occurs at a time and place when Indiana bats are present. Potential consequences of timber management include the removal of roost trees used by a maternity colony and migrants during spring and fall migration. Mortality or injury of individuals or small groups of roosting bats could result during the felling of trees that may harbor roosts. As explained in the Status of Species section, loss of roost trees could have substantial consequences for Indiana bats.

The proposed Plan, however, includes several standards and guidelines that greatly minimize the potential for these impacts to occur. Standards and guidelines require the Forest to assess and preserve trees of the size, structure, and species that Indiana bats are known to frequently use. In addition, activities that may affect suitable Indiana bat habitat will be performed outside of the summer season, when Indiana bats are not present. Indeed, since the discovery on Indiana bats

on the Forest, the Forest has restricted the vast majority of habitat-disturbing activities in potential Indiana bat habitat to the winter season. Continuation of this practice will allow the Forest to avoid direct impacts to Indiana bats for most timber management projects. However, while these guidelines will allow the Forest to minimize the likelihood for removing an occupied roost, the potential for this to occur remains.

As explained previously, the standards and guidelines only allow summer activity in optimal Indiana bat habitat after the area has been surveyed for Indiana bats using USFWS-approved methods. If reproductive female Indiana bats are discovered, activities will be postponed until the winter, thus avoiding direct impacts to maternity colonies. If males or non-reproductive females are discovered, the project may proceed using the established standards and guidelines. Under these circumstances, project activities may cause the injury or mortality of individual male or non-reproductive females. As explained above, we believe that it is extremely unlikely that surveys will fail to detect reproductive females if present. Therefore, direct negative impacts to maternity colonies should be extremely unlikely to occur, leaving the potential for impacts to singly roosting males and non-reproductive females only.

These individuals could also be exposed to noise and physical human disturbance. As anticipated above, such exposure is not likely to have any detectable fitness consequences. We anticipate that individuals that are disrupted may abandon a portion of their traditional home range during the disturbance, but are likely to readily locate new roosting or foraging areas within or near to their traditional home range.

Timber management activities that occur during the winter season may indirectly expose the individuals to alterations of their traditional summer areas. For the following reasons, however, we do not expect that any potential indirect impacts will have measurable fitness consequences on those individuals exposed. The proposed standards and guidelines for Indiana bat governing timber management will maintain roosts in sufficiently high densities (at least 9 trees/acre), favoring trees of the size, structure, and species that Indiana bats are known to frequently use. Standards and guidelines also require that timber management activities maintain potential foraging habitat and travel corridors. The methods used to maintain foraging habitat and travel corridors will vary according to the habitat configuration present, but will be addressed project-by-project. As adequate roosting and foraging habitat is maintained, the character in terms of Indiana bat habitat of the affected sites should be maintained such that Indiana bats will adapt to changes in their home range. Although some roost trees could be unknowingly cut during the winter, guidelines minimize the possibility of a primary or high quality secondary roost tree being felled, and they ensure that alternate primary roosts will be readily available within or very close to their traditional home range. Based on this information, we expect that any potential loss or degradation of Indiana bat habitat will be insignificant and will not yield negative fitness consequences for exposed individuals.

Furthermore, we expect that some timber management activities will benefit the Indiana bat and its habitat. In the long-term, implementation of the proposed Plan should increase the amount of suitable habitat by creating and maintaining potential roost trees, opening the forest canopy in roosting habitat, and designing stands with irregular borders and openings. In some situations, this will improve habitat suitability for roosting and reproduction by increasing solar exposure

for a number of potential roost trees. Proposed Timber Management methods will increase the overall tree size and proportion of hardwoods in a stand and increase the potential for large dead trees or snags that are suitable for roosting. These activities will improve the overall quality and quantity of Indiana bat habitat, and hence, improve the overall fitness of adult and young Indiana bats.

In summary, the proposed timber management actions should provide significant protection for Indiana bats and their habitat. We expect that the standards and guidelines will be successful at avoiding or reducing the potential for adverse impacts to the species throughout its range on the Forest. Nonetheless, potential for the take of a few male or non-reproductive females exists.

- Fire Management

The primary goal of the fire management program on the Forest is to reduce the size and intensity of wildfires. While Indiana bats are not confined to fire-dependent habitats, they may occupy habitats that are maintained by fire. For example, oak savanna, which is maintained by fire, provides some potential Indiana bat habitat on the Forest. In these habitat types, wildfire suppression can decrease the suitability of that habitat for Indiana bats. Woody vegetation may encroach on oak savannas, increasing understory clutter and decreasing openings, which would degrade Indiana bat habitat (roosting, foraging, travel corridors). In addition, wildfire suppression could decrease the amount of fire-created snags that could serve as roost trees. However, with so few Indiana bats on the Forest, their tendency to occupy habitats that are not dependent on fire, and the sporadic nature of wildfires, any decrease in roosts should not measurably impact Indiana bat roosting potential. Overall, impacts from wildfire suppression should be greatly reduced by the Forest's proposed prescribed burning activities (discussed below) which work to mimic the effects of fire in these habitats.

The proposed Plan increases the acres and size of prescribed burns and fuel reduction, establishes priorities for fire suppression and fuels reduction, decreases effects of suppression activities, implements rehabilitation activities in burned areas, encourages native vegetation, and uses smoke management practices. The proposed Plan includes treatment of approximately 8,000 acres of hazardous vegetation types per year and creation of 2,000 acres of fuelbreaks per year to lower the fire hazard to communities-at-risk. Burning programs for improvement of wildlife habitat will continue to be a priority for these and other species where necessary on the Forest. Roughly 3,000 to 6,000 acres will be burned annually by prescribed fire during the first decade. Prescribed fires will be of low to moderate intensities.

Appendix B details the fire management activities proposed by the Forest. The three main components of the Forest's fire management program are hazardous fuels reduction, prescribed burning, and wildfire suppression. The main environmental impacts associated with these fire components are reduced size and intensity of wildfires and maintained open habitats (maintain openings, reduce understory). Specifically, hazardous fuels reductions accomplished through mechanical means may cause temporary noise and physical disturbance, loss of forested habitat, and reduced proliferation of nonnative invasive species (NNIS). Wildfire suppression, accomplished through line control, aerial detection, and aerial control, may cause temporary noise and physical disturbance, temporary exposure of mineral soil, and increased erosion

potential. Prescribed burning, including fire and line control, may cause temporary noise and physical disturbance, smoke and airborne particulates, creation and destruction of snags, and reduced proliferation of NNIS. The following discussion details the potential Indiana bat exposure and response directly to fire management activities and their associated environmental consequences, as outlined in Appendix B.

Hazardous fuels reduction will be accomplished through mechanical methods. Potential consequences of hazardous fuels reduction include the removal of roost trees used by a maternity colony and migrants during spring and fall migration. Mortality or injury of individuals or small groups of roosting bats could result during the felling of trees that may harbor roosts. As explained previously, loss of roost trees could have substantial consequences for Indiana bats. Moreover, noise and physical disturbance may cause any Indiana bats present to permanently or temporarily abandon the roosting area. As we explained previously, the standard and guidelines greatly diminish the likelihood of reproductive females being exposed to either event. Lone roosting males or non-reproductive females could be exposed, however.

Prescribed burning activities may expose individuals to temporary noise, physical disturbance, smoke, and airborne particulates. Noise and physical disturbance may cause any Indiana bats present to permanently or temporarily abandon the roosting area. These activities may also result in the burning of occupied roosting areas. Indiana bats may be exposed to fire, smoke, or roost trees burning and falling. A summer fire that consumes or surrounds an occupied roost tree could injure or kill Indiana bats, especially non-volant young. While we generally assume that volant bats could escape fires, there are no data existing to refute or corroborate this assumption. A slow moving fire could conceivably be sensed by the bats early enough to allow both adults and young to escape, however, bats may not be able to respond quickly enough such that smoke, heat, and flames could interfere with the bats ability to navigate out of danger. Non-volant pups, if not rescued by an adult, would be exposed to smoke, heat and flames.

Indiana bats may also be exposed to smoke inhalation, which could induce respiratory distress or even death. Smoke could occur in the burn area itself, or drift into adjacent areas outside of the burn. Heat and flames could cause the death on any individuals not able to escape them. Given the standard and guidelines, we do not anticipate that reproductive females or young will be exposed to these stressors. Males and non-reproductive females could be exposed, however.

Prescribed burning activities may also indirectly affect Indiana bats through their prey base. Some insect species are vulnerable to fire in all life stages (Leach and Ross 1995, Hermann et al. 1998), and hence a portion of the available prey base may also be adversely affected. Prescribed burning may temporarily increase erosion potential, but several standards and guidelines limit the potential for erosion into streams and other aquatic habitats, making any potential impacts on prey items undetectable.

We also anticipate that any alteration to habitat from fire management activity performed during the winter will not adversely impact the fitness of individual Indiana bats. The standards and guidelines, as previously discussed, will ensure that the character of the affected areas will be maintained. Based on this information, we expect that the effects of any potential alteration of habitat will be undetectable. Moreover, we expect beneficial effects for Indiana bats to occur

with both hazardous fuels reduction and prescribe burning activities. In the short- and long-term, implementing the proposed hazardous fuels reduction actions should increase the amount of suitable habitat by creating and maintaining potential roost trees, opening the forest canopy in roosting habitat, and designing stands with irregular borders and openings. In some situations, this will improve habitat suitability for roosting and reproduction by increasing solar exposure for a number of potential roost trees. Proposed methods should increase the overall tree size in a stand and increase the potential for large dead trees or snags that are suitable for roosting. These activities may improve the roosting potential, increasing the survival of adult and young Indiana bats.

Prescribed burning may also benefit bats by improving the foraging habitat and increasing the arthropod prey abundance (Lyon et al. 2000a, Lyon et al. 2000b, Carter et al. 2002). Burning may also control and reduce some types NNIS, which should benefit Indiana bat in the long-term by improving biodiversity, and hence prey availability.

Wildfire suppression may impact the environment in many ways. Use of line control may cause temporary exposure of mineral soil, increased erosion potential, and physical disturbance. Exposure of mineral soil should not elicit any response from Indiana bats. Several standards and guidelines limit the potential for erosion into streams and other aquatic habitats, making any potential impacts on prey items undetectable. When using a tractor plow, line control may cause noise and physical disturbance. Line control will often be necessary during the summer season, potentially in occupied habitat. Indiana bats (male, females, young) may be directly exposed to these activities when they occur at a time and place when they are present. However, we do not expect any adverse impacts to Indiana bats from these activities. Line control occurs on a limited basis on the Forest, which decreases the likelihood that Indiana bats will be exposed. In addition, line control causes a focused linear impact that should leave most of any potential Indiana bat home range untouched. For this reason, we do not expect that line control to adversely impact the fitness of Indiana bats.

The Forest also uses aerial techniques to suppress wildfires. Aerial detection and control using airplanes and helicopters should not result in a level of disturbance to elicit a response from Indiana bats because the aircraft do not fly close enough to the tree tops.

- Minerals and Geology

Appendix B details the minerals and geology management activities proposed by the Forest. The two main components of this program are oil/gas development and sand/gravel mining. There are approximately 480,000 acres of federally owned oil and gas rights on the Forest. Currently, there are 77 authorized federal leases on the Forest, covering approximately 60,000 acres. In addition to Federal mineral leasing, there are currently 758 State of Michigan oil and gas leases covering approximately 33,000 acres of state mineral interest on the Forests. Presently, there are 32 producing oil and gas wells on National Forest System lands within the Forests' boundaries. The proposed Plan includes the potential for increased oil and gas development on the Forest. The Forest must recognize privately-owned mineral rights on the Forest are recognized, and reasonable access for exploration or extraction are provided. A lease notice associated with sensitive wildlife, such as Karner blue butterfly and Kirtland's warbler, would state that

operations would be subject to more restrictive species-specific controls, such as no surface occupancy. Oil/gas development includes access roads, facilities construction, and operation. The primary environmental impacts from oil/gas development are tree removal, noise and physical disturbance, habitat fragmentation, and increased human presence.

As suitable habitat and mineral resources overlap, Indiana bats could be directly and indirectly exposed to construction and operation of oil/gas facilities. Potential impacts include the removal of roost trees used by a maternity colony and migrants during spring and fall migration. Mortality or injury of individuals or small groups of roosting bats could result during the felling of trees that may harbor roosts. Noise and physical disturbance from facility construction and operation may cause any Indiana bats present to permanently or temporarily abandon the roosting area. The potential impacts of access roads associated with oil/gas development are discussed under the transportation management section (specifically OML 1-2 roads).

Sand and gravel production from several pits on the Forests is sporadic, averaging approximately 10,000-20,000 total cubic yards per year. Additional development of sand mining is limited by State regulations (Critical Dunes Designation) and further gravel mining is not anticipated. Gravel mining includes the operation of current mines, since no new mines are expected. The main impacts from gravel mining are noise and physical disturbance and habitat fragmentation. Indiana bats may be exposed to these stressors and may abandon their traditional habitat areas in response.

However, the proposed Plan includes several standards and guidelines applicable to minerals and geology management that greatly minimize the potential for injury and mortality of Indiana bats. Activities will be performed outside of the summer season when reproductive females are present, and thus, reproductive females and young are not likely to be exposed. Males and non-reproductive females could be exposed, however, the standards and guidelines require the Forest to assess and preserve trees of the size, structure, and species that Indiana bats are known to frequently use. This greatly minimizes, but does not eliminate, the possibility of an occupied roost tree being felled.

Both facility construction and gravel mining may also cause habitat fragmentation, increased erosion and runoff potential, and facilitate establishment of NNIS. We expect that habitat fragmentation will be very limited in size and should not alter the character of the affected site in terms of suitable Indiana bat habitat. Standards and guidelines limit the potential for erosion into streams and other aquatic habitats, making any potential impacts on prey undetectable. Establishment of NNIS in such a small area should not have a detectable impact on Indiana bats.

We expect that operation of either oil/gas or gravel mining facilities will not have any negative fitness impacts for Indiana bats. Some amount of human access for maintenance and operation of sites, along with noise from machinery can be expected. However, we do not anticipate that the level of disturbance associated with these facilities will be great enough to elicit a negative response from Indiana bats. Furthermore, gravel mining occurs on a very limited area of the Forest. If bats are present in these areas, they should be acclimated to these activities. We do not anticipate any negative effects for future use of the area by bats if not present already.

Summary of Effects Associated with the Proposed Plan.

We anticipate that the proposed Plan with its standards and guidelines will improve the quality and quantity of suitable habitat for Indiana bats within the action area. The fitness of some individuals may be adversely impacted as a result of wildlife, fish, and sensitive plants; timber; fire; and minerals and geology management actions. We anticipate, however, that the standards and guidelines will greatly limit the extent to which these adverse effects will occur. Specifically, we anticipate that reproductive females and young will not be exposed directly to any stressor associated with these management actions. We also anticipate that only lower quality roost trees could be removed during the summer period as a result of these activities, which minimizes the potential exposure of males or non-reproductive females. If such individuals are exposed, we expect either a single or a few roosting bats will be present. Thus, any harm at the individual level (i.e., adult injury or mortality) will not have negative population-level consequences. That is because we expect at most only a few individuals could be exposed, and that the worse-case scenario of death of these few individuals would not result in a significant population-level response. That is, the loss of few individuals—whether they be male or female—will not reduce the fitness overall population to which they belong.

Although all of the potentially suitable Indiana bat habitat in the action area could be altered through implementation of the proposed Plan, much of this alteration should result in long-term habitat improvements for the Indiana bat. Moreover, the standards and guidelines require the maintenance of potential current and future roosting sites, along with potential foraging habitat and travel corridors. These requirements will ensure that the character of affected sites will be maintained in the short-term as well. In addition, activities which may directly or indirectly affect the Indiana bat and its habitat would likely be distributed across the Forest over time, and not just focused in Indiana bat habitat. Project-level analysis (Tier II) will occur and at that time any additional protective measures needed to avoid or minimize adverse effects will be identified.

In summary, the proposed Plan will 1) protect the Tippy Dam hibernacula and swarming sites; 2) maintain, protect, and create foraging and roosting habitat; 3) obtain information on population distribution, status and trends; and 4) conduct research that aids the survival and recovery of the Indiana bat. Thus, we anticipate that there may be short-term adverse effects, but over the long-term the proposed Plan will benefit Indiana bats occurring within the action area overall. We do not anticipate detectable negative consequences to the species as a result of the adverse impacts that may result from the proposed Plan. As such, we do not anticipate detectable reductions in reproduction, numbers or distribution for the species.

Cumulative Effects

Cumulative effects include the combined effects of any future State, local, or private actions that are reasonably certain to occur within the action area covered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Although we are aware of no major non-Federal actions are reasonably certain to occur within the action area, it may be expected that some activities, particularly on private lands, could have a progressive negative effect on Indiana bats in the action area. Human populations in the counties with potential Indiana bat habitat have been rapidly increasing in recent years (USDAFS 2003a). Human population growth is typically accompanied by increased urbanization, including road construction and land development. Both of these activities could result in the permanent loss of potential Indiana bat habitat. Additional actions performed on private lands that may adversely affect the Indiana bat in the future are fire suppression, application of pesticides, and timber harvest.

The development of privately-owned mineral rights is possible on both private and Forest Service lands. Mineral rights on Federal lands are subject to an environmental analysis, review, oversight, and permit from the Federal agency. The Federal agency, however, may not be able to condition a permit in a manner that would preclude the development of the resource. In such cases, the Forest may not be able to impose a “no surface occupancy” stipulation in the permit for mineral extraction in potential Indiana bat habitat, and the species may be adversely affected. However, since there are no known mineral developments that are reasonably certain to occur, we cannot presently account for them into our jeopardy analysis for this species.

Conclusion

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Indiana bat. Critical habitat for this species has been designated, however, there is no designated critical habitat in the action area and, thus, no destruction or adverse modification of that critical habitat is anticipated.

Currently, we believe that there are potentially less than 65 Indiana bats occupying the Forest. This small number of individuals limits potential exposure to Forest Service activities. Furthermore, the standard and guidelines proposed greatly diminish the likelihood of reproductive females and young being exposed directly. However, implementation of the proposed Plan may adversely impact the fitness of males and non-reproductive females occurring within the action area. These adverse consequences are most likely to be either as injury or death of individual Indiana bats from direct exposure to management actions. We do not expect that these adverse impacts will, however, elicit population or species-level responses. We anticipate the overall beneficial effects of the proposed action will maintain and improve roosting and foraging habitat and hence the fitness of Indiana bats occurring within the action area. Thus, overall impact on the conservation status of the local population to which these individuals belong to and on the species rangewide is anticipated to be positive. So, we conclude that the proposed action is not expected to, directly or indirectly, reduce appreciably the likelihood of both the survival and recovery of this species in the wild by reducing their reproduction, numbers, or distribution.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

In general, an incidental take statement (ITS) specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize the impacts of the take and sets forth terms and conditions which must be complied with in order to implement the reasonable and prudent measures.

Relationship of Program-level ITS to project-level ITS

Any future actions completed under the proposed Plan that may adversely affect the Indiana bat will require section 7 formal consultation. These consultations will follow the procedures outlined in the “Programmatic Consultation Approach” section in the accompanying biological opinion (beginning on page 4). A Level 2 biological opinion will be written and appended to this biological opinion for each project that may adversely affect the Indiana bat. During Level 2 consultation, project-specific incidental take, as well the cumulative amount of take pursuant to implementation of the proposed Plan, will be assessed. Section 9 exemption under the terms of sections 7(b)(4) and 7(o)(2) of the Act will be granted, if appropriate. In these future ITSs, reasonable and prudent measures and terms and conditions to minimize the effect of any incidental take that may result will be developed and applied, as appropriate.

Amount or Extent of Take

In this ITS, we are evaluating the incidental take of Indiana bats that may result from implementation of the proposed Plan. A Forest Plan is a permissive plan level document that allows and guides, but does not authorize, specific actions to occur. As explained within the accompanying biological opinion, the proposed Plan allows for actions that are likely to adversely affect the Indiana bat. As such, specific actions conducted under the proposed Plan may result in adverse effects to individual Indiana bats that rise to the level of take. The standards and guidelines proposed as part of the proposed Plan, however, substantively reduce the potential for adverse effects and incidental take to occur. Therefore, projects completed under the proposed Plan that comply with the standards and guidelines in many cases will not

adversely affect the Indiana bat such that take would be anticipated. There may be situations, however, in which incidental take is likely regardless of whether the standards and guidelines and other project commitments are adhered to. Specifically, we anticipate that take could occur during 1) timber harvest, 2) prescribe burning, 3) minerals and geology, and 4) wildlife, fish, and sensitive plant management activities.

This section addresses only a subset of the adverse effects analyzed in the Effects Analysis section. Specifically, we identify the effects that will: 1) rise to the level of take and are reasonably certain to occur, and 2) are within the action agency's discretion. Thus, adverse effects that not expected to rise to the level of take, are not reasonably certain to occur, or are not under the jurisdiction of the action agency are not considered in this ITS.

Incidental take of Indiana bats is expected to be in the form of injury, death, or harassment. We believe that the standards and guidelines sufficiently limit summer season activities so that only lower quality alternate roost trees may be cut. These trees, if occupied, would likely have either lone roosting males or a few non-reproductive females. It is reasonable to assume that only a subset of these individuals would be directly taken through injury or death (Bellwood 2002) and that most of the individuals in the occupied roost tree would escape. We anticipate that such a roost tree could be cut during any of the four management activities identified above. Although very difficult to predict with certainty, we believe such an event is unlikely to be more than once per activity. Thus, we anticipate that no more than 4 occupied roost trees would be incidentally cut, and hence, no more than 16 individuals could be injured, killed, or harassed over the next ten years.

We will monitor incidental take of Indiana bats as individual projects are completed. At the project level we will have more information, such as habitat suitability and proximity to known occupied areas. This information will allow us to more precisely assess the Indiana bat demographics within the project action area, how likely it is that they will be exposed to the project impacts, and how they will likely respond to the exposure. Take will be tallied as the projects are implemented. Prior to implementing each project, we will ensure that the cumulative take does not exceed what was anticipated in the programmatic ITS.

Incidental take of Indiana bats will be difficult to detect for the following reasons: the species is highly mobile; the species occurs in habitat (e.g., trees) that makes detection difficult; and finding dead or moribund bats is unlikely due to a small body size and the likely scavenging of specimens by predators. However, we believe the level of take of this species can be monitored by tracking the level of habitat modification and adherence to standards and guidelines. Specifically, if the standards and guidelines are not implemented, or if the current anticipated level of habitat loss is exceeded, we fully expect the level of incidental take to increase as well.

We will monitor the level of incidental take (1) using the number of acres of each management activity, and (2) by monitoring the implementation and effectiveness of the standards and guidelines (see Requirements for Monitoring and Reporting subsection below). The proposed Plan identifies the extent to which these management activities will occur on the Forest over this planning period (quantatively or qualitatively). As long as these management activities do not exceed the levels anticipated in the proposed Plan, we do not anticipate take to exceed 14 bats.

Effect of Take

In the accompanying biological opinion, we determined that the proposed action is not likely to jeopardize the continued existence of the Indiana bat or destroy or adversely modify its critical habitat. Therefore, we have determined that the level of anticipated incidental take associated with the actions completed under the proposed Plan is not likely to jeopardize the Indiana bat.

Reasonable and Prudent Measures

As this is program-level consultation and no specific projects that will result in take are analyzed within, there is no incidental take to exempt at this level. We believe, however, that the following Reasonable and Prudent Measure and associated Terms and Conditions may be applied to some project level consultations (Level 2) in the future to minimize the effect of incidental take that may result from such projects.

- Reduce the potential to impact the Indiana bat in areas of the Forest where it is most likely to occur.

We believe that, where appropriate on a project-by-project basis, the reasonable and prudent measure outlined above will significantly reduce the impacts of incidental take of Indiana bats on the HMNF.

Terms and Conditions

In order to reduce the potential to impact the Indiana bat in areas of the Forest where it is most likely to occur, the following terms and conditions may be applied on a project-by-project basis. The applicability of each term and condition will be determined based on the technical requirements and biological characteristics associated with the specific action being analyzed.

1. Protect Indiana bat habitat within 5 miles of Tippy Dam by establishing management area prescriptions that emphasize Indiana bat habitat and allow for activities compatible with Indiana bat management.
2. Ensure that all Forest Service employees working within Indiana bat habitat are educated to recognize and avoid potential Indiana bat roost trees and the required habitat components for a complete Indiana bat home range. As necessary, educate contractors and volunteers working within Indiana bat habitat those habitat components.

Additional Terms and Conditions in future Level 2 biological opinions may be required for some future projects where site-specific details dictate.

Requirements for Monitoring and Reporting of Incidental Take of Indiana Bats

Federal agencies have a continuing duty to monitor the impacts of incidental take resulting from their activities [50 CFR 402.14(i)(3)]. In doing so, the Federal agency must report the progress of the action and its impact on the species to the Service as specified below.

1. Supply the Service with an annual report, due by January 31 of each following year, that specifies:
 - a. the amount of suitable affected habitat in the current year and the total affected since issuance of this biological opinion by:
 - i. timber management
 - ii. fire management
 - iii. minerals and geology management
 - iv. wildlife, fish and sensitive plant management
 - b. the effectiveness of the Indiana bat standards and guidelines in protecting Indiana bats and their habitat. Examples include photos or snag counts, etc. for some projects as appropriate,
 - c. progress and results of any terms and conditions that were required, identified by project,
 - d. the number of live or dead Indiana bats encountered, and
 - e. results of any Indiana bat surveys completed.
2. Care must be taken in handling dead bat specimens that are found to preserve biological material in the best possible condition. Any dead specimens found should be placed in plastic bag and refrigerated as soon as possible following discovery. The finding of any dead specimen should be reported immediately to the Service's East Lansing Field Office.

We anticipate that the taking of up to 16 Indiana bats on the Forest may occur as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We believe that the Forest has already initiated or participated in important efforts to protect, manage, and increase our understanding of the Indiana bat, including their commitment to implement the standards and guidelines in the proposed action. We offer the following Conservation Recommendations to further expand the knowledge of this species, and help better manage for the Indiana bat in Michigan.

- If female Indiana bats are found during surveys, conduct a radio telemetry study to determine the location of the maternity roost. Upon location of the maternity roost, coordinate with the Service in the establishment of a protection zone around the colony. This information would be valuable in managing for the species on the Forest.
- If a male Indiana bat is found during surveys, conduct a radio telemetry study to evaluate the habitat use (i.e., roosting trees and foraging). This information would be valuable in managing for the species on the Forest.
- Periodically evaluate the utility and possibility of funding of increased monitoring of the Indiana bat population that hibernates in Tippy Dam from a 5-year to a 2-year schedule, per recommendations in Kurta 2002.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

Karner Blue Butterfly

Status of the species

This section presents the biological or ecological information relevant to formulating the biological opinion. The purpose is to provide the appropriate information on the species life history, its habitat and its range-wide distribution and conservation status for analyses in later sections. This section also documents the effects of all past human and natural activities or events that have led to the current status of the species.

The primary source of information for this section is the Karner Blue Butterfly Recovery Plan (USFWS 2003c)

Species Description

The Karner blue butterfly (KBB) is a member of the Order Lepidoptera, Family Lycaenidae. Adult butterflies are rather small, with a wingspan of between 2.2 and 3.2 centimeters. The KBB has two broods, or adult flight periods, each year. In typical years, first brood larvae hatch from overwintered eggs in mid to late April and begin to feed on wild lupine (*Lupinus perennis*), the only known larval food source. Near the end of May, the larvae pupate and adult butterflies emerge in late May to early June. The adults are typically in flight for the first 10 to 15 days of June when the wild lupine is in bloom. Female KBBs lay eggs on or near wild lupine plants. The eggs hatch in about one week and the larvae feed for about three weeks. They then pupate

and the second brood of adults appears about the second or third week of July. This flight of adults lay their eggs among leaf litter or on grass blades at the base of lupines or on lupine pods or stems; these eggs do not hatch until the following spring. Generally, by late August, no adults remain. Cold and/or rainy weather can delay the two flight periods of the butterfly.

Immature stages (eggs, larva, and pupae) of KBB have a mutualistic relationship with ants. Larvae tended by ants have a higher survival rate, grow relatively rapidly, and gain weight more rapidly per amount of food eaten. The ants benefit from this relationship by using as food a liquid secreted by the larvae.

In addition to wild lupine, the KBB requires tall grass for late afternoon basking and overnight roosting, some shading vegetation to prevent overheating, a source of water, and nectaring sources for the adults. A variety of understory plants serve as nectaring sources for the adults.

Population Dynamics

The historic habitat of the butterfly was the savanna/barrens ecosystems. Much of that habitat has been destroyed by development, fragmented, or degraded by succession. Because such habitats can be lost to succession, KBB persistence is linked to disturbance and/or management that renews or creates these necessary habitats. Literature on the historic distribution of the KBB suggests that this species occurred as shifting clusters of populations distributed across a vast fire-swept landscape covering thousands of acres. While the fires resulted in localized extirpations, vegetative succession following these fires maintained suitable habitat and allowed rapid population expansion.

The KBB is an example of a species for which suitable habitat occurs in relatively small areas (or patches) distributed over larger areas. Like other species whose habitat occurs in patches rather than large continuous tracts of land, populations of the KBB exist as dynamic collections of subpopulations that are interconnected genetically by dispersal. Collectively these interconnected subpopulations make up a metapopulation. Metapopulations continually shift in distribution across the landscape as habitat patches change from suitable to unsuitable habitat due to varying stages of disturbance and succession. No one theoretical metapopulation structure is advocated for the KBB; rather, the recovery plan focuses on those factors that would restore healthy metapopulations including sufficient suitable habitat, connectivity of subpopulations, and management. Persistence of metapopulations is governed by the balance between extirpation of subpopulations and recolonization of unoccupied suitable habitat sites.

To preserve species with patch distributions, it is necessary to maintain existing patches of suitable habitat, the processes that create new habitat patches, and the corridors that allow a species to migrate between habitat patches (Harrison et al. 1988). Open linear areas such as road and railroad rights-of-way, utility corridors, and forest roads and trails can serve as dispersal corridors for the KBB, allowing them to recolonize or colonize wild lupine patches. Research has shown dispersal of the KBB to range from about 600 ft (183 m) to about 2 mi (3.2 m).

Distribution

Historically, KBB occurred in a narrow geographic area that extended from eastern Minnesota across portions of Iowa, Wisconsin, Illinois, Indiana, Massachusetts, Michigan, Ohio, Pennsylvania, New York, New Hampshire, Maine, and the province of Ontario, Canada. Over the past 100 years, KBB populations have declined significantly throughout the species' range. It is now believed extirpated from Ontario, Canada; Maine; Massachusetts; Pennsylvania; Iowa; and possibly Illinois.

Presently, the KBB occupies remnant savanna/barrens habitat and other sites that have historically supported these habitats, such as silvicultural tracts (e.g. young pine stands), rights-of-way, airports, military bases, and utility corridors. Since the only known food plant for KBB larvae is wild lupine, the distribution of the butterfly is closely tied to the distribution of habitats that support the wild lupine. In the Midwestern states, the habitat is generally dry prairies, sandy openings, including openings in oak savannas, jack pine (*Pinus banksiana*) stands, and dune or sandplain communities. Habitat is also sometimes present along road, railroad, and utility line rights-of-ways and in forest plantations.

Currently in Region 3 of the Service, natural populations of the KBB occur in Minnesota, Wisconsin, Indiana, Michigan, and Ohio, and may occur in Illinois. In 1998, KBB were reintroduced to Ohio as part of a 5-year reintroduction program. Each state retains its own state list of imperiled species. For the KBB, the states of Minnesota, Indiana, and Ohio list the species as endangered. In Michigan, it is listed as threatened, and in Wisconsin as a species of special concern.

Illinois- The only known occurrence of KBB in Illinois is in Illinois State Beach Park in Lake County. The KBB was considered extirpated from Illinois in 1992 until one KBB was recorded from the Illinois State Beach Park in 2001. Efforts are underway to restore KBB habitat and reintroduce KBB to the Illinois State Beach Park and Spring Bluff Forest Preserve just north of that site.

Indiana- Historically, the KBB was reported from eight counties in Indiana. Currently, the species is found in only two counties (Lake and Porter), with the largest population occurring in or near Indiana Dunes National Lakeshores in Lake County. A significant number of subpopulations occur on private land adjacent to the National Lakeshores and a few on country-owned lands and in Gary, Indiana. In 2001, The Nature Conservancy began a reintroduction project to restore a viable population of KBB to West Gary. Numbers in Indiana have clearly declined since 1998-1999.

Minnesota- KBB currently only occur at the Whitewater Wildlife Management Area in southeastern Minnesota. There are other locations in the southeastern and east-central part of the state that formerly supported lupine, however, several of these sites are no longer present.

Ohio- The only population of KBB occurs in Kitty Todd Preserve in northwestern Ohio. In 1998, KBB were reintroduced to this site as part of an on-going 5-year reintroduction program. Prior to reintroduction, KBB had been seen last in Ohio in 1988.

Wisconsin- Wisconsin has the most numerous and widespread KBB occurrences among the six KBB states in Region 3. Most of the Wisconsin subpopulations can be lumped into about 15 large population areas, many of which are found on sizable contiguous acreages in central and northwest Wisconsin. Some of the largest KBB populations are found at Necedah National Wildlife Refuge, Fort McCoy, Glacial Lake Grantsburg Work Unit (which includes Fish Lake and Crex Meadows State Wildlife Areas), Eau Claire County Forest, Jackson Country Forest, and Black River State Forest.

Michigan- The KBB is currently found in 10 of the 11 Michigan counties in which it historically occurred. KBB populations in those counties are reduced and highly fragmented. Many of the KBB sites occur on state land in Flat River and Allegan State Game Areas, and on Federal land in Huron-Manistee National Forest. An equal number of sites occur on private land.

Conservation Status

The KBB was proposed listed as endangered on December 14, 1992. No critical habitat has been designated for this species. A final recovery plan was published in the Federal Register on September 19, 2003 (USFWS 2003c). In general, the recovery strategy for this species is to perpetuate viable metapopulations of the KBB in the major ecological regions throughout its geographic range. Thirteen ecological regions are identified in the KBB Recovery Plan (called "recovery units" [RUs]), based on known variation in physiography, climate, and vegetation, and potential geographic genetic variation in KBB populations. Wisconsin and western Michigan now harbor the largest metapopulations of KBB that occur in the greatest amount of area in the geographic range of the species. The goal for these areas is to stabilize and maintain, and in some cases expand, the populations that now occur. Because of the significance of these two states as the centers of KBB abundance, more RUs and more metapopulations are established in these areas than in other parts of the range. These multiple RUs should protect the species against wide scale declines in either state.

The RUs in Minnesota, and parts of Indiana, and possibly parts of Michigan have imperiled populations. The goal for these areas is to protect existing habitat (both occupied and unoccupied sites) and to increase, stabilize, and maintain the existing populations. Fewer metapopulations are established in these RUs.

Finally, six potential RUs are identified. These potential RUs are nonessential for recovery, but it would be beneficial to the species if viable metapopulations were recovered in these RUs. Potential RUs within Region 3 of the Service are located in the states of Ohio, Illinois, Wisconsin, and Minnesota. For details on conservation and recovery activities occurring in each RU refer to Appendix B of the KBB Recovery Plan.

Based on a review of the 2004 KBB survey data from the six states considered in this opinion, it appears that KBBs are generally stable in Michigan, although some declines are being seen on Huron-Manistee National Forest. KBB numbers are increasing in Ohio due to the successful on-going reintroduction program. In Indiana KBBs have been stable for the long term, but have been periodically lost, or are declining on some sites. The butterfly is experiencing a downward trend in Minnesota, although the population is persisting in low numbers. In Wisconsin

populations are stable to increasing due to continued surveys for the species, and protection of some of the larger metapopulations (e.g., Necedah NWR and Fort McCoy). The status of the KBB in Illinois is unknown but may periodically be present in very low numbers at one site, Illinois State Beach Park.

Threats

The most significant threat to the KBB is habitat loss, alteration, and destruction. This has been accompanied by increased fragmentation of the remaining suitable habitat. Originally, barrens and savanna were widespread in the central United States. There has been a precipitous decline in these habitats. Remaining barrens and savanna usually consist of isolated patches, which persist because of doughty soils, insects and disease, and human disturbance such as mowing, light grazing and intermittent prescribed or wild fires. Habitat loss has resulted in a reduction in the number of KBB subpopulations, habitat fragmentation, and smaller sized occupied sites. Habitat degradation has reduced the abundance and quality of the KBB's food resources (lupine and nectar plants) and microhabitat diversity. A major contributor to habitat degradation is the disruption of the natural dynamic processes that maintain the quality of KBB habitat. Human use of KBB habitat and adjacent areas is the primary cause of disturbance suppression.

Incompatible management practices threaten some populations of KBB, such as poorly timed or poorly located use of herbicides, insecticides, and mowing; management that promotes high densities of deer and ruffed grouse; and frequent use of high intensity prescribed fire. Even on areas with concordant management goals, too vigorous a pursuit of these goals has been detrimental to the butterfly. For example, while mowing can be an effective management tool some precautions are warranted. Mowing can directly crush eggs or larvae; damage or reduce the density of lupine plants, eliminating food for larvae; and decrease nectar sources. Similarly, prescribed fire can threaten KBB populations if the burning is conducted on the majority of the available habitat, or if high intensity fires are used at frequent intervals.

Summary and Synopsis of the Species Status

The status of the KBB varies by state. Recent data indicates that KBBs are generally stable in Michigan, although some declines are being seen on Huron-Manistee National Forest. Karner blue butterfly numbers are increasing in Ohio due to the successful on-going reintroduction program. In Indiana KBBs have been stable for the long term, but have been periodically lost, or are declining on some sites. The butterfly is experiencing a downward trend in Minnesota, although the population is persisting in low numbers. In Wisconsin populations are stable to increasing due to continued surveys for the species, and protection of some of the larger metapopulations (e.g., Necedah NWR and Fort McCoy). The status of the KBB in Illinois is unknown but may periodically be present in very low numbers at one site, Illinois State Beach Park. The most significant threats to the KBB is habitat loss, alteration, fragmentation and destruction. There has been a precipitous decline in barrens habitats and the remaining areas usually consist of isolated patches. This habitat loss has resulted in a reduction in the number of KBB subpopulations, habitat fragmentation, and smaller sized occupied sites.

Environmental Baseline

This section describes the species status and trend information within the action area. It also includes State, tribal, local, private actions already affecting the species or that will occur contemporaneously with the proposed action. Unrelated Federal actions that have completed formal or informal consultation are also included in the environmental baseline.

Status of the Species within the Action Area

The KBB is found in the Manistee side of the Forest, in the Newaygo and Muskegon Recovery Units (Figure 4). The Newaygo RU is located in west central Michigan, in six counties (Mason, Lake, Oceana, Newaygo, Mecosta, and Montcalm), and is associated with oak or white pine barrens scattered throughout the Newaygo outwash plain and sandy terminal moraines. Topography is relatively flat and the climate is colder and more variable than the other Michigan RUs. Oaks and pines dominate the sandy soils. The Muskegon RU is located in west central Michigan along Lake Michigan, in four counties (Mason, Oceana, Newaygo, and Muskegon), and is associated with oak or white pine barrens scattered through the Manistee sand lake plain. It corresponds to ecoregion subsection IV.4 as described in Albert (1995). Climate is moderated by Lake Michigan, but is colder and more variable than other RUs in Michigan. There is considerable topographic relief in some parts of this RU.

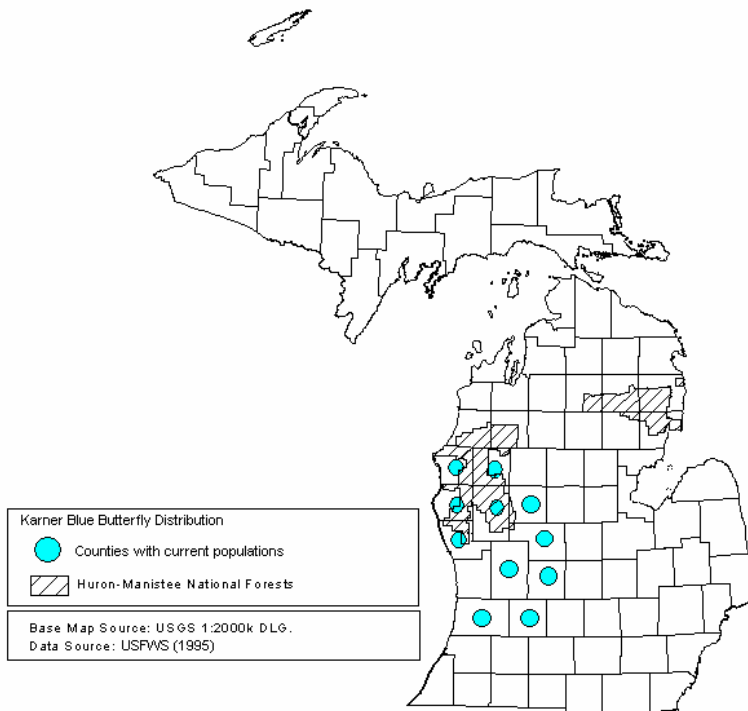


Figure 4. Distribution of the KBB in Michigan (from USDAFS 2003a).

Most known sites for the KBB on the HMNF are strongly associated with the Forest's LTA 1, which is classified as Sandy Outwash Plains, characterized by poorly developed, excessively

well-drained sands in the mesic to frigid soil temperature zone. Landscape scale habitat is found in MAs 2.1, 4.2, 4.3, 4.4, 6.1, 6.2, and 8.1, with most occurring in area 4.2, “Roaded Natural Sandy Plains and Hills.”

Within the action area, approximately 13,396 acres (5,421 ha) of the HMNF and about 784 acres (317 ha) of private land were surveyed for the presence of KBBs from 1989 to 2001. From these surveys, approximately 263 KBB-occupied areas have been found on HMNF lands and 56 occupied areas were found on private lands. These occupied areas comprise 2,026 ac (820 ha) of HMNF land and 441 ac (178 ha) of private ownership (Joe Kelly, HMNF, pers. comm. 2003).

The areas of occupied and potential habitat on the HMNF have been segregated into four (Central, Southeast, Southwest, and North) KBB Management Areas (KBBMA) distributed in the two RUs as follows: Central and Southeast KBBMAs in the Newaygo RU, Southwest and North KBBMAs in the Muskegon RU. The KBBMAs collectively contain 24 Management Units (KBBMU) delineated based upon concentrated areas of LTA 1. These encompass all the areas of occupied or potential KBB habitats on the HMNF. The four KBBMAs are separated by habitat that is unsuitable for KBBs, Connectivity or the potential for dispersal between the four KBBMAs is currently unknown. Karner blue butterflies occupy primarily five of the KBBMUs: Otto (Southwest KBBMA), Burns Lake (Southwest KBBMA), M-37 (Central KBBMA), Croton (Southeast KBBMA), and White River (Southwest KBBMA) (USDAFS 1994, USDAFS 2002b).

Factors Affecting The Species Within The Action Area

The Forest Plan for the Forest was first implemented in 1986. The Plan underwent formal section 7 consultation; however, the KBB was not considered because the species was not yet listed as under the Act. Therefore, the standards and guidelines for management actions provided no special protection or consideration for the KBB. As a result, it is possible that this species was adversely affected by management activities; however, as population status was not known, the extent of adverse effects is not determinable. Potential adverse effects most likely occurred as habitat conversion to incompatible uses (e.g., roads, trails, red pine plantations) and killing of individuals through management activities, such as burning or cutting, applied in without regard to the KBB in occupied habitat.

In 1992, shortly after the KBB was listed as endangered, the Forest began communicating with the Service’s East Lansing Field Office on consultation requirements for KBB management plan. The management activities described in the Management Plan included nectar plant seeding or propagation, mowing, cutting, scarification, and burning on occupied sites. On October 13, 1994 the Forest initiated formal consultation to address the potential effects of these proposed management activities for the KBB on the HMNF from 1994 to 1999. During this six-year period, the Forest proposed to manage 920 acres for KBBs, of which 606 acres were occupied. The proposed management included a variety conservation measures intended to reduce the impact to the butterfly while conducting beneficial management actions.

In its March 28, 1995 biological opinion, the Service analyzed the potential effects of the proposed management activities and determined that implementation of the Management Plan was not likely to jeopardize the continued existence of the KBB. We determined that the

proposed management activities would likely result in a net benefit to the KBB by improving habitat conditions and increasing numbers of butterflies in the action area. Incidental take of eggs, larvae, and adults was permitted on the basis of total known occupied acreage affected annually. A total of 580 acres were authorized for the six year period (see Table 1, page 13, of the March 29, 1995 biological opinion). This biological opinion was amended on June 18, 1998, to increase the amount of incidental take allowed to 651 acres. According to a May 23, 2002 letter only 457 acres were treated in the 1994-1999 period.

Although the management plan and biological opinion were not officially been extended past 1999, The Service has been working with the Forest to address and minimize the potential effects of any incidental take resulting from management activities. As of 2002, a total of 500 acres of KBB habitat have been managed and restored on the HMNF (Joe Kelly, HMNF, pers. comm. 2003). Implementation of the KBB management plan has helped ameliorate the adverse effects of past management activities and improved the overall status of the species in the action area.

The Forest currently monitors the KBBs using presence/absence surveys (USFS 2003b). While population numbers and trends cannot be determined from this type of information, they provide an indication of the species status. Based on this data, the presence of KBBs has appeared to decline in recent years, despite restoration activities (USFS 2003b). The Forest believes that the following factors may be responsible for the apparent KBB declines in these units (Joe Kelley, HMNF, pers. comm. 2003; USFS 2003b):

- Decreased lupine due to drought conditions have resulted from several years for below normal precipitation in Michigan. These particular KBB units may be more susceptible to drought due to soil conditions (e.g., low clay content) which inhibits moisture retention.
- Increased deer browsing of lupine in these KBB units.
- The topography of these units, with low depressional areas, increases the occurrence of growing-season frost pockets that may damage lupine and other plants.
- Increased OHV use that may damage lupine or kill individuals

The status of other areas of KBB habitat are also believed to be decreasing due to lack of management or restoration activities focused on restoration and maintenance for this species (Joe Kelley, HMNF, pers. comm. 2003). Other areas of red pine that were planted before the KBB was listed will eventually shift into mature red pine plantations and will become unsuitable for KBBs if restoration activities do not occur (USFS 2003b). Given these trends, the continued management, research, and restoration of KBB habitat will be essential to the species' survival on the Forest.

Activities by other entities that have had an impact on the KBB within the action area are discussed below.

Cooperative Gypsy Moth Suppression Project, Michigan

In 1996, the USFS State and Private Forestry Division formally consulted on a proposed gypsy moth suppression project for 22,579 acres in Mecosta, Muskegon, Newaygo, and Oceana

counties. The proposed action was to aerially apply the biological insecticide *Bacillus thuringiensis* var. *kurstaki* (Btk) to private residential and public recreational lands. Many of the properties proposed for treatment were on non-Federal lands within the HMNF administrative boundary. The Btk is lethal to KBB larvae as well as gypsy moth larvae, and if KBBs occurred within a spray block, mortality was expected.

In a May 31, 1996 biological opinion, we analyzed the effects of the proposed action and determined that the project, as proposed in 1996, was not likely to jeopardize the continued existence of the KBB. Survey indicated that the KBBs occupied approximately 20 percent of areas with suitable soil types (LTA 1) on the HMNF. Therefore, we assumed that KBBs could occur on up to 20 percent of the project treatment acreage within suitable soil types. Incidental take was authorized for the 20 percent of the treatment acres with the potential to support the species that may be occupied; this number was equivalent to 1,097 acres. In addition, the terms and conditions stipulated that no more than 50 percent of any area known to be occupied by KBBs may be treated with Btk and no area shall be treated in consecutive years. All areas with lupine were assumed to support KBBs (see page 18 of the May 31, 1996 biological opinion for more details).

Portions of at least two, possibly four, of the proposed treatment blocks were known to be occupied by the KBB. It is not known, however, exactly what portion of the suitable habitat that was authorized for take was actually occupied by the KBB. It is possible that there were treatment blocks of suitable KBB habitat that were not occupied, and thus take did not reach the authorized amount. We expect that some level of take did occur, however, since there were some areas of known occupied habitat included in the treatment blocks. Since it is impossible to quantify the actual amount of take that occurred, it is prudent to assume incidental take occurred on all authorized 1,097 acres, although it was likely less than this. There are a total of 131,694 acres of potential habitat within the HMNF, based on areas with LTA 1 classification (USFS 2003a). Given the estimated occupancy rate of 20 percent in potential habitat, we can assume that KBBs may occur on up to 26,338 acres within the HMNF. Furthermore, laboratory studies indicated an approximately 80 percent mortality rate of Karner blue caterpillars treated with Btk (Herms 1996). It is likely that a portion of the KBBs in a spray block would be pupae, adults, or eggs and may not be affected by the Btk. Based on this information, it is unlikely that any KBB population was eliminated with any single application of Btk. Thus, the amount of take authorized in 1996 was likely less than 4 percent of the total potential occupied habitat in the action area, and did not appreciably diminish the potential long-term survival and recovery of the KBB in the action area.

In 1999, consultation for this project was reinitiated as new information became available. The 1999 gypsy moth suppression project consultation considered treatment of 5,087 acres of suitable KBB habitat in Allegan and Muskegon counties. Most of the proposed spray blocks with potential to affect the KBB were private or State lands within or near the HMNF boundaries. These areas were proposed for treatment with Btk or Gypcheck[®], a newly developed virus for biological control specific to gypsy moths, that does not affect KBBs. Following informal consultation, the USFS agreed to apply Gypcheck[®] in place of Btk on all spray blocks within one mile sections adjacent to sections with a known KBB occurrence. Using this application strategy, known occurrences of KBB within proposed spray blocks would not be

sprayed with Btk, and unknown occurrences within one mile of known occurrences will also be avoided. No known KBB occurrences were proposed for treatment with Btk; however, we again believed that unknown occurrences might be sprayed with Btk and the USFS entered into formal consultation. In the May 6, 1999 biological opinion, we analyzed the effects of the proposed action and determined that the project was not likely to jeopardize the continued existence of the KBB. Based on the same reasoning used in the previous biological opinion, we determined that unknown KBB occurrences may be present on about 20 percent of the 5087 acres with a soil type suitable for lupine, and authorized take for no more than 1,017 acres.

When the project was continued in 2000, the USFS determined that it was “not likely to adversely affect” the KBB. In the previous biological opinions, we concluded that unknown KBB occurrences may be present on about 20 percent of LTA 1. This was reconsidered in 2000, however, because further analysis determined that no data existed to support this conclusion. Based on the following parts of the USFS 2000 proposed action: 1) all occupied sites and sites adjacent to occupied sites were treated with Gypcheck[®], which is not toxic to KBBs and 2) none of the Btk treatment areas were known to have KBBs present, no adverse effects from the project were expected. Based on the best available data, no known or unknown occurrences of the KBB were likely to be adversely affected by the proposed action and thus, it was not possible to identify any incidental take of the species that was reasonably certain to occur. In addition, based on this analysis, it is unlikely that there were any adverse effects from this proposed action in 1999, and the incidental take authorized for 1,017 ac was not likely realized. In a May 10, 2000 letter, we concurred with the “not likely to adversely affect” determination made by the USFS and rescinded the May 6, 1999 biological opinion.

Informal consultation with the Service takes place annually for this project. The HMNF, in consultation with the Service, has cancelled proposed Btk treatments, or replaced Btk with Gypcheck[®], on or near occupied KBB habitat. The availability and use of Gypcheck[®] continues to provide a reasonable, safe alternative to Btk, and ongoing Michigan Cooperative Gypsy Moth Suppression Projects are not likely to result in adverse effects or incidental take of KBBs.

Consumers Energy Muskegon River Hydroelectric Project Lands

On June 7, 1999, the Federal Energy Regulatory Commission (FERC) initiated formal consultation on a KBB management plan for areas of occupied and suitable habitat on Consumers Energy hydroelectric project lands along the Muskegon River in Newaygo County. The action area included the Croton Boat Launch Powerline Corridor (Croton site) and the Newaygo Park State Park Powerline Corridor (Newaygo site); both of these sites fall within the HMNF boundaries. The proposed action included conducting prescribed burns, managing for lupine and other crucial components of KBB habitat, and protecting KBB habitat from human disturbance. In a February 24, 2000 biological opinion, we determined that implementation of the proposed management plan was not likely to jeopardize the continued existence of the KBB. Incidental take was authorized on the basis of known occupied habitat, and included 0.3 acres for Area 1 and 0.13 acres for Area 7 of the Croton site (for more detail, see pages 11-13 of the February 24, 2000 biological opinion). No prescribed burning has been conducted on this site, although other management activities have been implemented.

The Croton site has become degraded for a variety of reasons in recent years. The highest quality habitat at this site occurs at the top of a bluff, on the bluff face, and near the boat launch. In June of 1999, areas of the Croton site were sprayed with a broad-spectrum herbicide, killing lupine and other plants in the area. In response to this incident, Consumers prepared a Damage Assessment and Restoration Plan that included planting and re-establishing colonies of lupine. Consumers protected this area from human disturbance by putting up a guardrail. In September 2001, a accidental human-caused wildfire burned a portion of the site at the top of the bluff. In addition, the area at the top of the bluff is heavily trampled during annual Fourth of July fireworks displays. A drought in recent years has severely reduced the lupine on the bluff face (G. Dawson, Consumers Energy, pers. comm., 2003). The newly planted area is threatened by spotted knapweed invasion.

Although the Croton site is degraded, KBBs persist in relatively small numbers. An extant population of KBBs was re-discovered at the Newaygo site in 2002; this site currently provides higher quality habitat than the Croton site. The management and restoration efforts, as detailed in the Consumers KBB management plan, will continue to be critical in maintaining the remnant populations of KBBs both sites.

Section 10(a)(1)(A) Permit for The Nature Conservancy (TNC), Clawson Tract

The Nature Conservancy actively manages for KBB on the Clawson Tract, which has approximately 35 acres of occupied KBB habitat. The major management need on this property is the control of invasive alien plants that are competing with native nectar plants and lupine. The management actions include prescribed burning, hand removal and spot herbicide treatment of exotic species, and native plant reintroduction. There are six management units on the tract. The Clawson tract is within the boundaries of the HMNF. TNC's current section 10(a)(1)(A) permit (Permit TE022454-1) authorizes the take of all KBBs incidental to conducting habitat management activities on Unit 1 of the Clawson Tract, which is approximately 5 acres. In March 1999, a prescribed burn of Unit 1 was conducted. Spot burning and hand-removal of exotic species has also been conducted in Unit 1. Because this type of active management is required for the persistence of suitable KBB habitat, implementation of these restoration actions have improved status of the species in the action area.

Other natural and human caused factors

Michigan has experienced several years of below average precipitation. The resulting dry conditions are suspected to have reduced the survival of lupine in some areas of KBB habitat on the HMNF (J. Kelly, USFS, pers. comm. 2003).

Some privately-owned lands in the action area that formerly supported KBB populations ago have been lost to succession, agricultural conversion, forestry, and development. Furthermore, activities such as OHV use, pesticide use, and mowing and burning are known to occur in KBB habitat (USFS 2003a; J. Kelley, USFS, pers. comm. 2003). While this has resulted in lost habitat, the KBB is known to occupy disturbed areas, such as powerlines and gas pipeline corridors, old fields, forest openings, roadsides, and lightly stocked oak stands (USFS 2003a).

Overall, it is likely that these climatic conditions and human activities have reduced the extent and quality of KBB habitat in the action area.

Summary and Synthesis of the Environmental Baseline

Approximately 263 KBB-occupied areas have been found on HMNF lands and 56 occupied areas on private land within the HMNF boundary. Occupied areas in the action area include 2,026 acres in Federal ownership and 441 acres in private ownership (J. Kelly, USFS, pers. comm. 2003). Areas of occupied and potential habitat on Manistee NF have been segregated into and are managed as four KBBMAs containing 24 management units. Current presence/absence monitoring data indicate that, despite active management by the Forest, populations of KBB on the HMNF may be declining. Factors such as succession, land conversion, recreation, drought, deer browsing, and frost-pockets, are adversely affecting these populations.

Effects of the Action

This section assesses the effects of the proposed action, including the direct and indirect effects together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). This section also assesses the cumulative effects, including the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area.

Analysis of the Effects of the Action

Effects of the Forest Plan Goals, Objectives, and Desired Conditions on the Karner blue butterfly

The proposed Plan emphasizes habitat necessary to sustain minimum viable populations that represent existing native throughout the Forest. Maintenance and improvement of populations of endangered, threatened, or sensitive species will continue to be a Forest priority. For the KBB, the proposed Plan puts significant emphasis on restoring oak barrens. The proposed Plan also directs a net reduction in the miles of roads on the Forest by emphasizing closures of roads determined to be non-essential for resource management.

The proposed Plan directs that recovery plans for listed species, including the KBB, be implemented. The proposed Plan also ensures that partnerships will continue by directing cooperation and coordination with responsible government and land and resource management agencies, tribes, and partners regarding endangered, threatened, and sensitive species.

We believe that the overall goals, objectives, and desired conditions of the proposed Plan are consistent with the ecological needs of the KBB. We expect that implementation of this plan will protect and manage for viability KBB populations and assist in achieving its recovery.

Effects of the specific management actions on the Karner blue butterfly

Although the overall goals of the proposed action are expected to have a beneficial effect for the KBB, the means by which the Forest will achieve the goals may cause adverse effects to this species. This analysis assesses the likelihood and magnitude of impacts that may result directly or indirectly from specific proposed management actions or from the long-term operation of management activities. Specifically, we assess the measurable and detectable responses of KBBs exposed to the proposed management actions and the environmental impacts associated with the actions, and the likelihoods of the exposure and the consequent response occurring.

Effects to KBBs from various management activities depend on the likelihood of exposure to that activity or any associated environmental consequence and the type of KBB response. Occasionally there will be events in which direct exposure will be unavoidable, and the resulting habitat alterations may have positive or negative indirect effects on KBBs. For both direct and indirect exposure, KBB responses will vary from no detectable behavioral response to potential death. The program-level analysis lacks definitive temporal and spatial information for the specific management actions. Although the standards and guidelines assist with narrowing our scope of analysis by specifying timing and habitat restrictions, our analyses are necessarily broad. Thus, we identify both the range of possible responses and the most likely responses anticipated for each management activity. Many of the standards and guidelines significantly reduce the potential impacts for KBB, effectively neutralizing most potential negative responses. However, some potential for negative responses remain.

The most significant environmental consequences associated with all management actions proposed are: removal of forested habitat, spread or control of NNIS, Maintenance of openings and fire-dependant habitats. As indicated above, the responses of individuals exposed directly to the management action or these associated environmental consequences will vary depending on the timing and scale of the management action. The analyses below describe how each management activity is expected to affect Indiana bats. Appendix C identifies the proposed management actions and associated their project elements, the environmental impacts resulting from these project elements, and the likely responses of individuals exposed to these environmental impacts. It also describes the anticipated effects to the affected population in terms of reproduction, numbers, and distribution. These tables were intended to be read in concert with the following effects analysis section.

The standards and guidelines that reduce exposure and responses are described in more detail in the Proposed Action section. It is important to emphasize that this effects analysis is predicated on the fact that all standards and guidelines will be fully implemented. If not, this analysis may no longer be valid.

- Range Management

The four active grazing allotments on the Forest are not within KBB habitat, and they will not be exposed to any range management activities.

- Watershed Management

Karner blue butterfly habitat does not tend to be associated with streams, lakes, or riparian areas. Therefore, we do not expect KBBs to be exposed to any watershed management actions.

- Minerals and Geology

We do not expect KBBs to be exposed to minerals and geology activities. There are no gravel mines currently operating in KBB habitat and none are proposed. All federally or State-owned mineral leases on the Forest have a "no surface occupancy" stipulation in KBB habitat.

- Forest Pest Management

Most nonnative invasive species (NNIS) control in KBB habitat is accomplished by prescribed burning, which will be analyzed in the fire management section. The Forest does not anticipate using mechanical control of NNIS in KBB habitat.

Standards and guidelines prohibit the use of chemicals (e.g., pesticides, insecticides, herbicides) in or adjacent to occupied KBB habitat between April 1 and August 15, except when the wind is not blowing toward the habitat, and there is a minimum buffer of 100 feet between the habitat and the treatment area. Furthermore, the Forest committed to apply any pesticide only after an environmental review, including section 7 consultation to address any potential effects on listed species. Given these measures, it is extremely unlikely that KBBs will be exposed to any chemical control.

Biological control of purple loosestrife using beetles has been underway on the Forests for four years and appears to be effective in the locations where it has been used. Karner blue butterflies should not be directly exposed to these beetles since purple loosestrife does not occur in KBB habitat. Moreover, these beetles are not known to have any impacts on plant hosts for any Lepidopteran species. Although the proposed Plan permits other biological pest controls to be used on the Forest, none are planned at this time.

In general, pest control should improve biodiversity, which should improve KBB habitat and increase the overall persistence and survival of the species on the Forest.

- Transportation Management

Karner blue butterflies may be impacted by a variety of transportation activities. The Forest does not anticipate any new roads in occupied KBB habitat (P. Huber, USFS, 2005). However, the operation and maintenance of existing roads will continue. KBBs may be exposed to roadside maintenance and resurfacing. However, these activities occur in very limited areas and are not expected to have a measurable impact on KBB habitat. Environmental impacts expected from operation of existing roads include loss of forested habitat, human activity, and spread of NNIS.

Road traffic may damage or disturb habitat, harming or killing individual KBBs and degrading lupine and other habitat elements where vehicles drive off-road. On some high-speed roads (i.e.,

primarily OML 3-5), adult KBBs may be killed by impacts with vehicle traffic while moving and dispersing over roads. Karner blue butterflies have also been observed using road-rut ponds as a water sources which may increase their potential to be killed by vehicles.

Standards and guidelines in the proposed Plan require that roads in KBB habitat be managed to restrict human use to the trails using signage and brush piles. Furthermore, the BA indicates that roads will be temporarily or permanently closed, altered, relocated, or decommissioned where they are adversely impacting the KBB or its habitat. Nevertheless, these impacts may negatively affect some KBBs on the Forest.

Transportation may facilitate the spread of NNIS into KBB habitat. Many NNIS may reduce lupine and other native plants that provide nectar sources for adult KBBs. This could decrease the numbers and distribution of KBBs on the Forest. Spotted knapweed, while moving in and choking out some native plants, also serve as a nectar source for adult butterflies. However, spotted knapweed tends to dominate and reduce the overall site biodiversity, increasing risk of extirpation of the KBB subpopulation. The Forest has an active habitat management program for KBBs and other species that addresses NNIS. While NNIS may adversely impact KBBs on the Forest, we do not expect that this will cause any take of butterflies.

- Recreation Management

Recreational opportunities in KBB areas are primarily dispersed. There are no recreational facilities (e.g., campgrounds, parking lots) in occupied KBB habitat, nor are there any proposed. KBBs will be exposed primarily to foot and motorized trails, along with dispersed camping. Recreational activities may have a variety of impacts on KBB habitat, including soil disturbance and compaction, spread of NNIS, removal of forested habitat, and human activity.

Both foot traffic and motorized traffic may damage or disturb habitat, and harm or kill individual KBBs and degrade lupine and other habitat elements if these activities occur off designated trails. Karner blue butterflies have also been observed using road-rut ponds as a water sources which may increase their potential to be killed by impacts with OHVs.

Standards and guidelines in the proposed Plan strictly limit recreational activities in occupied habitat. In the past, dispersed camping sites have degraded occupied KBB habitat. Standards and guidelines in the proposed Plan require that these sites be signed and closed to camping, effectively eliminating this impact. Off-trail use of OHVs have also degraded KBB habitat. The proposed Plan includes standards and guidelines that restrict human use to the trails using signage and brush piles. Furthermore, the BA indicates that trails will be temporarily or permanently closed, altered, relocated, or decommissioned where they are adversely impacting the KBB or its habitat. While potential for adverse impacts remains, these measures should provide significant protection of KBB on the Forest.

Recreational activities may facilitate the spread of NNIS into KBB habitat. Many NNIS may reduce lupine and other native plants that provide nectar sources for adult KBBs. This could decrease the numbers and distribution of KBBs on the Forest. Spotted knapweed, while moving in an choking out some native plants, also provide suitable nectar sources for adult butterflies.

However, spotted knapweed tends to dominate and reduce the overall site biodiversity, increasing risk of extirpation of the KBB subpopulation. The Forest has an active habitat management program for KBBs and other species that addresses NNIS. Therefore, we expect any negative impact from NNIS to be unmeasurable.

- **Wildlife, Fish, and Sensitive Plant Management**

As detailed in Appendix C, management of wildlife, fish, and sensitive plants may have several environmental impacts on the KBB. Note that many actions that will improve habitat or otherwise benefit species on the Forest are expressed as standards and guidelines for other management activities, and will not be discussed here. Impacts of wildlife openings management will be discussed with barrens creation, under timber management below. KBBs should not be exposed to management of wetlands since they do not reside in or near wetland habitats.

Management that affects deer habitat may impact KBBs. Some vegetation prescriptions that provide deer habitat will increase under the proposed Plan, potentially causing localized increases in deer numbers. In particular, deer may benefit from the Forest's extensive barrens restoration program. Increasing deer populations may increase herbivory on wild lupine. This could cause the immediate death of those eggs and larvae. In the long-term, deer herbivory could decrease the overall rate of KBB reproduction by limiting lupine growth. Similarly, where deer habitat in association with KBB habitat is decreased, we would expect an associated decrease in lupine herbivory.

The proposed Plan contains provisions to implement recovery plans for listed species. This includes the recovery plan for the KBB. To achieve recovery of this species, the Forest must develop and maintain one viable population and three large viable populations. As such, participation by the Forest is absolutely essential in the recovery of this species. The recovery plan specifies that these population goals be achieved by the year 2023. The proposed Plan outlines an approach of creating and restoring oak barrens habitat on that timeline. The Forest has identified approximately 10,832 acres of habitat to manage to achieve KBB recovery on the Forest, in addition to approximately 9,648 acres of other essential habitat to be managed for KBBs. Of this habitat, approximately 7,332 acres will be restored in the first decade, with the remaining 12,968 restored in the second decade.

We expect that implementation of these actions will contribute positively to the overall conservation status of the KBB. Specifically, implementing these actions will facilitate the timely recovery of this species on the Forest and throughout its range. Any potential negative impacts of KBB management are discussed under timber and fire management below.

- **Timber Management/Fire Management**

Timber Management-General

As detailed in Appendix C, KBBs will not be exposed to most timber management activities. The oak savannas that KBBs occupy do not typically provide a large volume of wood and are not

managed through commercial timber harvest activities, such as even or uneven aged techniques. Similarly, salvage harvest and collection of firewood are unlikely to occur. There is potential for removal of hazard trees, but this should occur on a very limited basis in KBB habitat and we do not expect that it will cause measurable negative impacts.

Fire Management- General

As described in the Status of the Species section, fire is a dominant force shaping the oak barrens that provide KBB habitat. Without frequent fire, these barrens tend to become choked with woody vegetation that no longer provides suitable KBB habitat. The Forest has an active wildfire suppression program that essentially prohibits this natural fire disturbance regime. This has resulted in an overall decrease in the amount and condition of KBB habitat and decreased the populations on the Forest. Other consequences of the fire suppression program include noise/physical disturbance, exposure of mineral soil, and erosion. However, we do not expect these impacts to occur on a large enough scale to have measurable impacts on KBBs. Thus, primary consequence of the fire suppression program for the KBB is reduced frequency and intensity of wildfires.

Another component of wildfire suppression is management of hazardous fuel loads. The Forest will manage hazardous fuel loads in and near KBB habitat using prescribed burning (discussed below) and timber harvest. Timber harvest will remove forested cover and increase sunlight and the overall open nature of the habitat. The expected net effect of restoration is improved habitat conditions, evidenced by increased production and biomass of lupine and other nectar-producing plant species and suppression of woody vegetation. Improved habitat conditions should improve adult forage, breeding, and development of eggs and larvae. Timber harvest activities could also kill or injure KBBs. While adult butterflies are less likely to be directly impacted because mechanical treatments are not planned during flight periods, there could be short-term adverse direct impacts via crushing of eggs and larvae. As with other types of timber harvest, standards and guidelines indicate that activities in barrens undertaken by the Forest for the KBB will conform with current standards recommended by other sources of KBB management expertise, such as the Wisconsin Department of Natural Resources (2000) and the KBB blue butterfly Recovery Plan (USFWS 2003c).

Fire-Timber Management for Karner blue butterfly Habitat Restoration

To maintain habitat in the face of wildfire suppression, the Forest actively manages KBB habitat using timber harvest and prescribed burning. Timber harvest and prescribed burning will remove forested cover and maintain the open nature of the oak savanna habitat. Restoration will improve habitat conditions by increasing production and biomass of lupine and other nectar-producing plant species and suppressing of woody vegetation. These improved habitat conditions should increase adult foraging and breeding and increase numbers of eggs and larvae. Timber harvest activities, however, could also kill or injure KBBs. Over the short-term, timber harvest activities could cause eggs and larvae to be crushed. Direct impacts to adult butterflies is possible, but minimized because mechanical treatments are not planned during flight periods.

Management for the KBB could be detrimental to the species if not planned and executed appropriately. For example, prescribed burning could eliminate an entire population of KBBs if there is no source of individuals outside and near the treated areas to allow for repopulation. To appropriately restore and manage KBB habitat for maximum benefit to the species, the proposed Plan has standards and guidelines under which management activities will occur. These standards and guidelines conform to current standards recommended by other sources of KBB management expertise, such as the Wisconsin Department of Natural Resources (2000) and the KBB Recovery Plan (USFWS 2003c). Standards and guidelines require: 1) planning, both annually and cumulatively for the term of the project, for the appropriate amount, spatial arrangement, and rotation schedule of restoration sites to maximize habitat recovery and recolonization potential, 2) seasonal time restrictions for each restoration technique to minimize the potential for take and to maximize effectiveness, and 3) minimization of incidental habitat damage due to equipment or methodology. The Forest will also employ an active monitoring program to evaluate population and habitat responses, allowing for any necessary adjustments to be made.

Barrens management activities (fire and timber harvest) may facilitate the spread of NNIS into KBB habitat. Many NNIS may reduce lupine and other native plants that provide nectar sources for adult KBBs. This could decrease the numbers and distribution of KBBs on the Forest. Spotted knapweed, while invading and choking out some native plants, also provide nectar sources for adult butterflies. However, spotted knapweed tends to dominate and reduce the overall site biodiversity, increasing the risk of extirpation of the KBB subpopulation. The Forest has an active habitat management program for KBBs and other species that addresses NNIS. While NNIS may adversely impact KBBs on the Forest, we do not expect that this will cause any take of butterflies.

The Forest has identified approximately 20,480 acres of fire management for KBBs over this planning period. Of this, the propose managing 10,832 acres to achieve KBB recovery (metapopulation habitat) on the Forest and 9,648 acres outside of designated recovery areas (essential habitat). To date, 500 acres of currently occupied habitat has undergone restoration treatments. The barrens restoration would occur in decades 1 and 2 of the proposed Plan, and be fully implemented by decade 3. During the first decade, approximately 7,332 acres of habitat restoration will occur in metapopulations and essential KBB barren habitat. Of these acres, approximately 6,000 acres would occur within the recovery areas, which is approximately 56% of the barrens restoration objective for recovery on the Forest. An additional 1,332 acres of barrens restoration would occur in the additional essential KBB habitat. During decade 2, approximately 12,968 acres of habitat restoration will occur in the recovery areas and essential KBB barren habitat. Approximately 4,832 acres would occur within the recovery areas, which is the remaining 44% of the barrens restoration objective for recovery on the Forest. By decade 3, 100% of the acreage identified to meet recovery objectives would be met within the recovery areas. An additional 8,136 acres of barrens restoration would occur in the essential KBB habitat. Therefore, the Forest Plan would provide for the restoration of barren habitats for KBB within the 20-year timeframe identified in the USFWS Karner Blue Butterfly Recovery Plan.

Cumulative Effects

Cumulative effects include the combined effects of any future State, local, or private actions that are reasonably certain to occur within the action area covered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Approximately one-half of the total land acreage and approximately 18 percent of the known occupied acreage within the KBBMAs is under non-Federal, mostly private, ownership (USFS 1994, 2003a). Although we are aware of no major non-Federal actions that are reasonably certain to occur in the action area, it may be assumed that some activities, particularly on private lands, could have a progressive negative effect on the KBB in the action area. Human populations in the counties with KBB habitat have been rapidly increasing in recent years (USFS 2003a). Human population growth is typically accompanied by increased urbanization, including road construction and land development. Both of these activities may potentially result in the permanent loss of KBB habitat. Additional actions performed on private lands that may adversely affect the KBB in the future are fire suppression, mowing and grazing, OHV use, application of pesticides, and timber harvest. Additionally, the development of privately-owned mineral rights is possible on both private and HMNF lands. Mineral rights on Federal lands are subject to an environmental analysis, review, oversight, and permit from the Federal agency. The Federal agency, however, may not be able to condition a permit in a manner that would preclude the development of the resource. In such cases, the HMNF may not be able to impose a “no surface occupancy” stipulation in the permit for mineral extraction in KBB habitat, and the species may be adversely affected.

Conclusion

After reviewing the current status of the KBB, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the KBB. No critical habitat has been designated for this species, therefore, none will be affected.

Karner blue butterflies depend on early successional stage vegetation, primarily wild lupine. Historically, wild lupine was maintained by fire and other disturbances. The habitat management plan for KBBs proposed by the Forest attempts to mimic natural disturbances by use of prescription burns, mowing, cutting, and scarification. Although those management measures will result in some incidental take of eggs, larvae, and adults, they are necessary to preserve, enhance, and create habitat for the KBB. This level of adverse effects, however, is expected to be small and is not reasonably expected to, directly or indirectly, reduce appreciably the likelihood of both the survival and recovery of the KBB in the wild by reducing their reproduction, numbers, or distribution within the action area.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

In general, an incidental take statement (ITS) specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize the impacts of the take and sets forth terms and conditions which must be complied with in order to implement the reasonable and prudent measures.

Relationship of Program-level ITS to project-level ITS

Any future actions completed under the proposed Plan that may adversely affect the KBB will require section 7 formal consultation. These consultations will proceed using the procedures outlined in the “Programmatic Consultation Approach” section in the accompanying biological opinion (beginning on page 4). A Level 2 biological opinion will be written and appended to this biological opinion for each project that may adversely affect the Indiana bat. During this Level 2 consultation, project-specific incidental take, as well the cumulative amount of take pursuant to implementation of the proposed Plan that has occurred, will be assessed. Section 9 exemption under the terms of sections 7(b)(4) and 7(o)(2) of the Act will be granted, if appropriate. In these future ITSs, reasonable and prudent measures and terms and conditions to minimize the effect of any incidental take that may result will be developed and applied, as appropriate

Amount or Extent of Take

In this ITS, we are evaluating the incidental take of KBBs that may result from implementation of the proposed Plan. A Forest Plan is a permissive plan level document that allows and guides, but does not authorize, specific actions to occur. As explained within the accompanying biological opinion, the proposed Plan allows for actions that are likely to adversely affect the KBB. As such, specific actions conducted under the proposed Plan may result in adverse effects to individual KBBs that rise to the level of take. The standards and guidelines proposed as part of the proposed Plan, however, substantively reduce the potential for adverse effects and incidental take to occur. Therefore, projects completed under the proposed Plan that comply with the standards and guidelines in many cases will not adversely affect KBBs such that take

would not be anticipated. There may be situations, however, in which incidental take is likely regardless of whether the standards and guidelines are adhered to. Specifically, we anticipate that take could occur primarily during restoration of occupied KBB habitat, using timber harvest or prescribed fire. Some take is also anticipated with the operation of roads and trails in occupied habitat.

This section addresses only a subset of the adverse effects analyzed in the Effects section. Specifically, we identify the effects that will: 1) rise to the level of take and are reasonably certain to occur, and 2) are within the action agency's discretion. Thus, adverse effects that are not expected to rise to the level of take, are not reasonably certain to occur, or are not under the jurisdiction of the action agency are not analyzed in this ITS.

Recreation management may adversely impact KBBs on the Forest. The standards and guidelines in the proposed Plan, however, will be effective at controlling many impacts from recreation. The Forest will close (temporarily or permanently), alter, or relocate problem trails in occupied habitat, as necessary. However, potential for some adverse impacts remains, specifically from illegal off-trail use and camping. Where these activities occur in occupied habitat, eggs, larvae and possibly adults may be crushed, causing death or injury. Any take that occurs due to illegal activities is outside the jurisdiction and authority of the Forest Service and not exempted by this ITS and therefore not the responsibility of the Forest Service.

Incidental take of actual eggs, larvae, or adult KBBs will be nearly impossible to detect because finding a dead or impaired specimen is unlikely due to small body size, and losses may be masked by seasonal fluctuations in numbers or other causes. The level of take of this species can be anticipated by acreage of occupied habitat restored because habitat characteristics, particularly the presence of wild lupine, are adequately identifiable and actual presence of KBBs has been determined by survey. For each acre of habitat treated, we assume that all individuals occupying that acre were taken. Thus, incidental take of eggs, larvae, and adults will be permitted on the basis of total known occupied acreage affected annually.

The Forest will manage KBB habitat following strict guidelines that limit the amount and extent of take. Specifically, there are several guidelines that limit the amount of occupied habitat that may be treated annually by burning or any other method. Furthermore, the guidelines require that treated acres be left untreated for at least 3 years to allow them to develop suitable habitat. Also, most treatments will be planned for outside of the flight periods, to avoid take of adult butterflies. Provided that the Forest follows the guidelines for KBB habitat restoration as identified in the proposed Plan, restoration activities will be spatially and temporally designed to improve the species' status.

For the duration of the proposed action considered in this biological opinion, the Forest proposes to manage a total of approximately 20,300 acres of KBB habitat. Currently, 630 of these acres are known to be occupied. In the future, however, as restoration efforts progress, the occupied acreage should significantly increase. Thus, this incidental take statement anticipates the taking of all KBBs associated with restoration of up to, but no more than, 20,300 acres of KBB habitat on the Forest for the duration of the proposed action. This anticipated incidental take will be

apportioned and exempted annually by the Service, in consultation with the Forest on a project-by-project basis.

Effect of Take

In the accompanying biological opinion, we determined that the proposed action is not likely to jeopardize the continued existence of the species. Therefore, we have determined that the level of anticipated incidental take associated with the actions completed under the proposed Plan is not likely to jeopardize the KBB. Disturbance of this habitat is expected to be short term, that is, lupine and KBBs are anticipated to re-occupy disturbed sites after management treatments. Therefore, the take of KBBs is considered short-term. Furthermore, the restoration activities proposed by the Forest conform with current standards recommended by other sources of KBB management expertise, which are designed to minimize adverse effects. Thus, the expected net effect of the restoration is improvement of the habitat conditions and overall status of the KBB in the action area. Furthermore, these activities are designed to reverse the effects of land use practices that have caused the decline of the KBB and to restore habitat. Although these management actions are likely to result in the death of undeterminable number of individual eggs, larvae, and adults, they also are likely to cause an increase in the population of and produce long-term benefit for the species on the Forest.

Reasonable and Prudent Measures

As this is a program-level consultation and no specific projects that will result in take are analyzed within, there is no incidental take to exempt at this level. We believe, however, that the following Reasonable and Prudent Measures may be applied to some project level consultations (Level 2) in the future to minimize the effect of incidental take that may result from such projects, where appropriate on a project-by-project basis.

- Conduct all management in a manner that minimizes take to the maximum extent practicable.

We believe that, where required on a project-by-project basis, the reasonable and prudent measure outlined above will significantly reduce the impacts of incidental take of the KBB on the Forest.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the HMNF must comply with the following terms and conditions which implement the reasonable and prudent measures described above. In order to reduce the potential to impact the KBB, the following terms and conditions may be applied on a project-by-project basis. The appropriateness of applying each term and condition will be determined based on the technical requirements and biological characteristics of individual projects. Where required, these terms and conditions will be non-discretionary.

1. Ensure that all Forest Service employees and contractors are educated to recognize and avoid potential KBB habitat.
2. Seek new information annually on the distribution and status of KBBs in the action area and apply such information to management to minimize take.

Additional Terms and Conditions in future Level 2 biological opinions may be required for some future projects where site-specific details dictate.

Requirements for Monitoring and Reporting of Incidental Take of the Karner blue butterfly

Federal agencies have a continuing duty to monitor the impacts of incidental take resulting from their activities [50 CFR 402.14(i)(3)]. Furthermore, the USFWS must ensure that the actual effects from Plan implementation are commensurate with what the effects anticipated in the biological opinion. In doing so, the Federal agency must report the progress of the action and its impact on the species to the Service as specified below.

1. Supply the Service's East Lansing Field Office with an annual report, due by January 31st each year, that outlines the following:
 - a. The amount of occupied habitat restored in the current year and the total restored since issuance of this biological opinion. The report should include what methods were used and pre- and post-treatment photos.
 - b. Results of all monitoring activities, as outlined in the accompanying biological opinion and biological assessment.
 - c. Results of annual KBB metapopulation surveys.
 - d. Any incidents of take from illegal activities.
 - e. Progress and results of terms and conditions, as they were required, identified by project.
2. Progress on any terms and conditions implemented.
3. Salvage of specimens is unlikely due to the nature of the proposed activities and the physical characteristics of KBBs, eggs, and larvae. Therefore, no protocol is provided for salvage of specimens.

We anticipate the taking of all KBBs associated with restoration of 20,300 acres of occupied KBB habitat on the Forest is reasonably certain to occur as a result of the proposed action. This anticipated incidental take will be portioned and exempted annually by the Service, in consultation with the Forest on a project-by-project basis. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We believe that the Forest has already initiated or participated in important efforts to protect, manage, and increase our understanding of the KBB, including their commitment to implement the standards and guidelines in the proposed action. We offer the following Conservation Recommendations to further expand the knowledge of this species, and help better manage for the KBB in Michigan.

- Take action to improve habitat conditions and avoid or minimize take of KBB on private land within or adjacent to the HMNF by a) adopting an education program which includes, but is not limited to, landowner contact, either independently or preferably in cooperation with the Landowner Contact Program of the MDNR and MNFI already in progress; b) seeking opportunities to develop information on presence of KBBs on private land where owners are willing; and c) seeking opportunities, especially through partnerships, to help fund and carry out beneficial habitat management on private lands of willing owners.
- To the extent possible, develop information on the presence of Federal candidate plants and animals during the monitoring activity of the Plan and regular KBB surveys.
- Evaluate the contributions of drought, deer browsing, and growing-season frost on HMNF KBB populations, and propose potential solutions where necessary and prudent.
- Evaluate whether measures to address potential adverse effects of roads and trails are necessary and prudent.
- Adopt monitoring protocols following the draft KBB recovery plan.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

Pitcher's Thistle

Status of the species and critical habitat

This section presents the biological or ecological information relevant to formulating the biological opinion. The purpose is to provide the appropriate information on the species' life history, its habitat and its range-wide distribution and conservation status for analyses in later

sections. This section also documents the effects of all past human and natural activities or events that have led to the current status of the species.

Species Description and Life History

Pitcher's thistle is a monocarpic (flowers and sets seed only once), perennial, herbaceous plant, generally flowering after a 5-8 year juvenile stage (Loveless 1984). The stems and leaves of juveniles and adults are woolly-white, and the leaves are deeply pinnatifid with the lobes less than 1 centimeter (cm) wide and up to 4 cm long. Minute spines are concentrated along the edge of the leaf at its base, with a few spines between the lobes of the distal leaf margins. The flowering stems are up to 1 meter tall and have several to a dozen widely scattered leaves. Individuals typically have a single branching flowering stem with terminal and axillary flowering heads of a cream or pinkish color. Multiple stemmed plants are known, however, and the number of flowering heads per plant varies with habitat, latitude, plant size and year (Keddy and Keddy 1984), Loveless 1984). Juveniles and adults have a tap root that may reach 2 m in length.

Pollination occurs by several insects including members of Diptera, Lepidoptera and Hymenoptera families. It can take from 3 to 10 years to flower. Each plant flowers only once and then dies. Seed dispersal commences in late July at the northern limits of its range (Keddy and Keddy 1984), but can occur from June to August (McEachern 1992). Primary seed dispersal is through individual seeds blowing from the inflorescence head or by whole plant and heads falling to the ground at the end of the flowering season. Secondary dispersal is effected by wind blowing seed and seed heads across the sand, snow or water surface (Loveless 1984). Seed dormancy is broken by cold, moist stratification (Hamzé and Jolls, in press), and germination occurs in May and June (Loveless 1984). Following germination, seedlings appear which produce 1 to 6 leaves (Loveless 1984) in the first season. Seedling densities are greater where bare ground is abundant (McEachern et al. 1989) as compared to stabilized sites with greater vegetation cover.

Juvenile plants typically consist of 1 rosette, but if grazed, trampled or buried they may develop multiple rosettes (McEachern 1992). Juveniles may remain dormant for one or two years as a result of drought (McEachern 1992). Causes of mortality include human and animal trampling (Keddy and Keddy 1984, Gibson 1988), sand deposition and erosion (McEachern pers. comm., Weller pers. comm.), drought, and rabbit herbivory (Weller pers. comm.). Juveniles grow or maintain a constant size throughout the growing season, but may diminish in size over the winter (Loveless 1984, McEachern 1992).

Habitat and Ecology

Pitcher's thistle is one of a few plant species endemic to the post-Wisconsinian Great Lakes sand dunes. It occurs as one member of a dynamic dune ecosystem with a myriad of interacting species. The health of Pitcher's thistle populations indicates the general well being of dune ecosystems. No species is known to depend completely on Pitcher's thistle, but Pitcher's thistle provides a food (pollen, nectar and seed) source for many organisms (Keddy and Keddy 1984, Loveless 1984).

Pitcher's thistle occurs most frequently in the near-shore plant communities, although it occurs in all non-forested areas of the Great Lakes dune systems. It colonizes patches of open, windblown areas of the landscape, and gradually declines locally as the density of vegetation and ground litter increase through plant succession. Pitcher's thistle depends on a process of continual colonization of the mosaic of open habitats within the Great Lakes dunes. It is patchily distributed with varying population sizes in all open zones of dune vegetation, although its populations decline in stabilized, late successional secondary dune sites and in areas heavily used by the public. Pitcher's thistle density peaks in mid-successional habitats and requires 70% open sand for successful seedling establishment and survival (McEachern 1992).

For a particular occurrence of Pitcher's thistle to survive, disturbance must be frequent enough to prevent extirpation from succession and infrequent enough to allow juveniles to reach maturity; thus the Pitcher's thistle life history is finely tuned to a specific disturbance regime (McEachern 1992). Disturbances may eliminate local occurrences, but as long as those disturbances are not synchronous throughout the landscape and occurrence creation exceeds decline, the species will persist (Pavlovic 1994).

Pitcher's thistle depends on the geomorphic processes that maintain dune systems to create sparsely vegetated habitats where successful population establishment and growth can occur. In the past, disturbance and successional processes have maintained shifting dunes and produced a mosaic of sites suitable and unsuitable for Pitcher's thistle. The mosaic changed over time, but suitable habitat was available at all times. In any occupied site, as dune succession proceeds, increased vegetation cover and litter reduce the Pitcher's thistle germination and survival. Thus, as succession makes present-day habitat unsuitable, existing population patches will eventually be locally extirpated from the areas they now occupy. For the species to persist, new open habitats relatively near to existing occurrences and patches must be continuously created for Pitcher's thistle to colonize.

Status and Distribution

Pitcher's thistle is endemic to the beaches and grassland dunes of Lakes Michigan, Superior, and Huron (Guire and Voss 1963), with the majority of known sites occurring along the shores of Lake Michigan. The species ranges from the north shore of Lake Superior south to Indiana, and formerly occurred in northern Illinois, where it has been experimentally reintroduced (Bowles and McBride 1993 & 1994). It is also distributed along the Lake Michigan shoreline in Wisconsin. In the east it ranges through northern Lake Huron to the Manitoulin Island archipelago and southern Georgian Bay in Ontario.

Canada. Pitcher's thistle occurs at a total of 22 Lake Huron dune sites in Ontario (Jalava 2003). Although more than 25 percent of its geographic range is in Canada, the population that is supported by this range is less than 10 percent (Jalava 2003; Oldham and Line 1999). Pukaskwa National Park on the north shore of Lake Superior, in the Thunder Bay District of Ontario, is the northernmost population of this species. That population has been monitored for several years (Keddy 1988). The majority of Canadian occurrences are from Lake Huron, concentrated around Manitoulin Island and the Bruce Peninsula region. There are approximately 10,000 Pitcher's thistles plants in Canada.

United States. One hundred and ninety-one historic and existing occurrences are known in the United States, but 18 have been extirpated. Pitcher's thistle probably occurred more commonly along the Great Lake shorelines prior to European settlement, but it is unknown how many occurrences were lost due to settlement and shoreline development. Most of the known extirpated occurrences are in Illinois and Indiana.

Of the 173 extant occurrences, 156 (90 percent) are in Michigan and the remaining 17 are divided between Indiana and Wisconsin. Seventy-eight percent of the occurrences are in the Lake Michigan basin, with one occurrence (<1 percent) in the Lake Superior basin and the remainder (21 percent) in the Lake Huron basin. Sixty (35 percent) extant populations are entirely in public ownership, 42 occurrences (24 percent) cover adjoining public/private lands, and 71 (41 percent) occur on private lands. Most occurrences are considered to be of moderate quality; most high quality sites are on public lands or a combination of public and private ownership, while most low quality occurrences are found on private lands (USFWS 2002b). Most of the high quality sites are found in Michigan.

Threats/Reasons for Decline

Destruction, modification or curtailment of habitat or range.

Development, sand mining, beach and dune stabilization projects, and certain types of frequent recreation have destroyed, modified or curtailed approximately 10 percent of the Pitcher's thistle habitat, and reduced its range. Residential home construction, hotel and resort construction, road construction, condominium construction and marina construction have impacted occupied and potential Pitcher's thistle (Lake Michigan Development Commission 1987). Road construction can also negatively impact Pitcher's thistle habitat by allowing for accelerated invasion of shrub growth, which can expand into the dunes, decreasing thistle habitat, due to the local microenvironment for wind-sand deposition being altered, allowing the road edge to serve as a microsite that fosters shrub and other exotic invasive species growth (Ballard and Stuart 1995).

Trampling from beach and dune visitors, and OHV users also threaten Pitcher's thistle and their habitat, where such recreation is frequent and prolonged. For example, off-road vehicles destroy plants, create new blowouts, and severely destabilize dunes that are accessible. Trampling from high visitor use causes a decrease in survival and reproduction of individual plants and can cause seed bed destabilization (McEachern et al. 1989; McEachern 1992). Direct human trampling occurs primarily during the growing season and is caused by people hiking, climbing dunes, and hang gliding (Davis and Wood 1980). Trampling and high visitor use is a significant issue at certain areas in Wisconsin (Dobberpuhl and Gibson 1987), Indiana, Michigan and potentially in Illinois where beach and dune zones are quite narrow. Pitcher's thistle it is somewhat tolerant of disturbance from pedestrians and limited OHV traffic, especially true in the heart of its range where it is more abundant and seed sources are present to assist in replenishment.

Shoreline stabilization projects such as jetties, sea walls and rip-rap change sand supply through the alteration of off-shore sand transport, which alters local dune geomorphic processes and

precludes the creation and maintenance of Pitcher's thistle habitat (Dobberpuhl and Gibson 1987; McEachern et al. 1989). Sea walls and jetties were built along beaches containing Pitcher's thistle in Wisconsin, Indiana and Michigan (Dobberpuhl and Gibson 1987; McEachern et al. 1989). Planting to stabilize dunes also alters dune building processes and may decrease habitat available to the plants (Dobberpuhl and Gibson 1987; McEachern et al. 1989; Loope et al. 1995).

Foundry-sand mining operations are present along the Lake Michigan shore. The amount of sand mined has increased overall from 1.6 million tons in 1991 to 2.8 million tons in 2000 (MDEQ 2000). The impact on Pitcher's thistle is not known in the six counties with active sand mining permits and species occurrences. No Pitcher's thistle sites are being mined in Indiana or Wisconsin.

Natural or manmade factors affecting its continued existence.

Pitcher's thistle is threatened by fragmentation and possibly by genetic introgression. The long-term survival of Pitcher's thistle requires a shifting mosaic of suitable habitat available at all times so that, as areas are made unsuitable by succession, new areas of suitable habitat are created close enough for seed dispersal. Fragmentation prevents the creation of new areas of suitable habitat and likely interferes with seed dispersal.

Proximity of the common bull thistle (*Cirsium vulgare*) may present a potential threat of introgressive hybridization with Pitcher's thistle (Dobberpuhl and Gibson 1987). *Cirsium vulgare* is also the adopted host of several microlepidoptera (moths) that feed on native *Cirsium* spp. (Louda 2000). *Cirsium vulgare* in the vicinity could increase populations of the moths and lead to increased feeding damage on Pitcher's thistle flowerheads, over and above the significant levels already seen at some sites (Louda and McEachern 1995). Stabilization of large areas of the dunes by invasive non-native weeds, such as spotted knapweed, can also retard the natural maintenance of the shifting mosaic of suitable sand habitat. The magnitude of this potential threat needs to be monitored and quantified.

The flowerhead weevil (*Rhynocyllus conicus*) was introduced into several North American sites to control species of Eurasian thistles (*Carduus* sp.). This flowerhead weevil has spread to many locations, and has become naturalized (Louda et al. 1997). The flowerhead weevil develops on multiple native *Cirsium* species in the United States (Goeden and Ricker 1986a, 1986b, 1987a, 1987b; Turner et al. 1987; Louda et al. 1997), including *Cirsium canescens*, the putative progenitor of Pitcher's thistle (Johnson and Iltis 1963). Studies show that flowerheads of *Cirsium canescens* infested with flowerhead weevil bear only 14.1 percent as many seeds as flowerheads not infested with flowerhead weevil (Louda et al. 1997). Laboratory tests in the summer of 1999 demonstrated that this weevil will oviposit on Pitcher's thistle, and that it feeds and develops on Pitcher's thistle under common garden test plot conditions in Alberta, Canada (Louda et al. 2002). Thus, if the flowerhead weevil spreads to Pitcher's thistle range, and the Pitcher's thistle shows a comparable reduction in seed production, the flowerhead weevil poses a serious threat to Pitcher's thistle seed production and regeneration (Louda et al. 1997; Louda 2000).

Introduction of the rust *Puccinia carduorum* from Turkey to control the weedy non-native thistle (*Carduus nutans*) is under consideration by the United States Department of Agriculture (Politis et al. 1984; Bruckart and Dowler 1986). In a greenhouse study with conditions optimal for rust infection, Pitcher's thistle seedlings, but not adults, were susceptible to the rust infection. In a field trial no Pitcher's thistle plants were infected (William Bruckart, Agricultural Research Service, USDA, pers. comm. as cited in USFWS 2002b). A determination cannot be made from present data as to whether Pitcher's thistle is susceptible to infection under natural environmental conditions.

Global warming may increase drought frequency. Droughts may account for the poor success of Pitcher's thistle populations at the Indiana Dunes National Lakeshore (McEachern et al. 1989) and at other southern locations. Global warming may affect the water table levels along the Great Lakes shorelines and impact the species through altered shoreline processes.

Summary and Synthesis of the Species Status

Pitcher's thistle is a Great Lakes endemic. While Pitcher's thistle probably occurred more commonly along the Great Lake shorelines prior to European settlement, 195 occurrences remain widely distributed throughout the beaches and grassland dunes of Lakes Michigan, Superior, and Huron. Potential impacts to Pitcher's thistle is high due to the intense development pressure along the Great Lakes shoreline. Specifically, development, sand mining, beach and dune stabilization projects, and certain types of frequent recreation have already destroyed, modified or curtailed approximately 10 percent of the Pitcher's thistle habitat, and reduced its overall range. While many occurrences are found on protected lands, many are still open to private development pressures. Habitat fragmentation and the potential for exotic pests also present threats to Pitcher's thistle. At this time, most occurrences are considered to be of moderate quality, with most high quality sites on public lands or a combination of public and private ownership.

Environmental Baseline

This section describes the species status and trend information within the action area. It also includes State, tribal, local, private actions already affecting the species or that will occur contemporaneously with the proposed action. Unrelated Federal actions that have completed formal or informal consultation are also included in the environmental baseline.

Status of the Species within the Action Area

There are three known populations of Pitcher's thistle within the action area; two on Forest Service land one on private land. There are approximately 660 ac (267 ha) of potential Pitcher's thistle habitat on HMNF lands (K. Ennis, USFS, pers. comm. 2003) and an additional 100 ac (41 ha) of unoccupied potential habitat on two blocks of private land, one just north of the Lake Michigan Recreation Area and the other a much longer shoreline north to the Manistee NF boundary (K. Ennis, USFS, pers. comm. 2003). The two Pitcher's thistle populations within Manistee NF-- Big Sable Point and Cooper Creek Dunes-- occur in Mason County in areas

designated Critical Dune Areas by Michigan Department of Environmental Quality (USFWS 2002b; MSA 13a35301).

The Big Sable Point population is within the Nordhouse Dunes Wilderness (MA 5.1). It is one of the largest worldwide (>5000 individuals) and has an excellent habitat ranking of A, the highest possible rank. The Cooper Creek population is located approximately five miles to the north along the Lake Michigan shoreline outside of the wilderness in MA's 4.2 and 4.3 and is ranked CD, fair to poor, with significant human disturbance and fewer individuals.

The third population, Au Sable Point, is located on private property within the Huron NF proclamation boundary in Iosco County. This is a slightly smaller population with 500 to 5,000 individuals, on good habitat, with some human disturbance, and has a B ranking.

The federally-owned populations are periodically monitored by the Forest (USDAFS 1996; O'Connell and Stephens 2002). The monitoring tracks population trends and age class changes over time, changes in the habitat, and other threats (O'Connell and Stephens 2002). Monitoring data indicate that the total number of Pitcher's thistle plants generally decreased of 21 percent (751 to 596) from 1993 to 2001 (O'Connell and Stephens 2001). The monitoring also suggests an apparent correlation between the amount of bare ground and the presence of the Pitcher's thistle, with Pitcher's thistle being least abundant in the most stable, vegetated zones of its habitat.

Factors Affecting the Species Within the Action Area

The LRMP for the HMNF was first implemented in 1986. The LRMP underwent formal section 7 consultation upon its implementation. During this time, the Pitcher's thistle was listed as a category 1 candidate species, and not yet recognized as federally threatened. In the LRMP, however, the HMNF committed to including the Pitcher's thistle in its future formal consultations for actions that may affect the species. Since this time, no projects requiring formal consultation have been proposed. Since the listing of Pitcher's thistle in 1988 as a federally threatened species, the Forest has implemented these conservation and avoidance measures that have maintained or improved the status of this species in the action area by reducing the potential adverse effects to the Pitcher's thistle and improving potential Pitcher's thistle habitat on the Forest.

Although the reasons for recent dramatic shifts in Pitcher's thistle population size on the Forest are not fully understood, it is likely that a variety of factors play a role in the population dynamics of this species.

1. Dune processes

As previously discussed, the long-term persistence of Pitcher's thistle depends on the natural disturbance and variability of dune habitats. Parts of a population may be lost due to natural dune accretion and erosion, yet seed germination and population expansion requires the early successional habitat created by these processes (O'Connell and Stephens 2002; USFWS 2002b). Based on these dynamics, some natural amount of variability within a population is expected.

2. Non-native invasive species (NNIS)

Populations of Pitcher's thistle and unoccupied suitable habitat within the action area are impacted by invasions of exotic plants. Lombardy poplar is present within Pitcher's thistle habitat the project area. Lombardy poplar is the primary concern for the Pitcher's thistle because it is a dune stabilizer, known to inhibit the natural dune accretion and erosion processes (O'Connell and Stephens 2002). Spotted knapweed spreads with increased disturbance. The extent and severity of these effects within the action area has not been quantified (O'Connell and Stephens 2002).

Recreation activities take place at both sites on the Forest. Non-native invasive species can be introduced and/or spread on equipment, clothing, pets etc. It is likely that recreation activities such as hiking, picnicking and swimming have introduced and/or spread NNIS to both sites.

3. Recreation

Recreational use, specifically trampling from foot traffic (humans and their pets), has also been observed in Pitcher's thistle occurrences on the Forest. Trampling damages the rosettes and flowering plants and may cause seedbed destabilization (McEachern et al. 1989). The higher use areas at the day use area and campground at Lake Michigan Recreation Area, where the Cooper Creek population occurs, are especially vulnerable (O'Connell and Stephens 2002). The Big Sable Point population is within the Nordhouse Dunes Wilderness, where there is less access and recreational activities are not as prevalent.

4. Roads

The Cooper Creek occurrence is located in the Lake Michigan Recreation Area, which is in a motorized management area. This area has a large campground (including campers and RVs), hiking trails and a parking lot. While the campground roads are not near any Pitcher's thistle element occurrences, the roads facilitate a high level of human use.

The Big Sable Point population within the Nordhouse Dunes Wilderness is more protected because there is minimal road access to this area.

Summary and Synthesis of the Environmental Baseline

The three populations of Pitcher's thistle within the action area vary in size and condition. The Big Sable population is one of the largest range-wide and is the largest and highest quality Pitcher's thistle population in the action area. This population has suffered the fewest impacts due to its location in the Nordhouse Dunes Wilderness Area where most activities are restricted. The Cooper Creek population is smaller and more impacted because it falls in areas with fewer activity restrictions. Plant numbers in these populations have fluctuated, but generally decreased in recent years.

The Au Sable population, however, is privately owned and outside of the jurisdiction of the Forest; there are no data available regarding population numbers and trends of this population.

This occurrence is also small, but has had fewer impacts and is in better condition than the Cooper Creek occurrence.

Potential impacts from various Forest activities have been significantly reduced by implementation of conservation measures to minimize and avoid adverse impacts. However, it is likely that impacts from recreational activities, roads, and invasive exotic species have affected and continue to adversely affect the Pitcher's thistle within the action area. This is especially evident in the Cooper Creek population which is characterized by low plant numbers and poor habitat quality.

Effects of the Action

This section assesses the effects of the proposed action, including the direct and indirect effects together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). We are not aware of any actions that are interdependent or interrelated to the proposed action being considered in this biological opinion.

Analysis of the Effects of the Action

Effects of the Forest Plan Goals, Objectives, and Desired Conditions on the Pitcher's thistle

The proposed Plan emphasizes habitat necessary to sustain minimum viable populations that represent existing native species throughout the Forest. Maintenance and improvement of populations of endangered, threatened, or sensitive species will continue to be a Forest priority.

For the Pitcher's thistle and other shoreline species, the Forest will manage much of its habitat as a wilderness area characteristics, such as a natural appearance and seclusion. Outside of the wilderness, other shoreline areas receive more intense management and use. However, this habitat is still managed for natural conditions with use restrictions.

The proposed Plan directs that recovery plans for listed species, including the Pitcher's thistle, be implemented. The proposed Plan also ensures that partnerships will continue by directing cooperation and coordination with responsible government and land and resource management agencies, tribes, and partners regarding endangered, threatened, and sensitive species.

We believe that the overall goals, objectives, and desired conditions of the proposed Plan are consistent with the ecological needs of the Pitcher's thistle. We expect that implementation of the proposed Plan will protect and manage for viability Pitcher's thistle populations.

Effects of the specific management actions on the Pitcher's thistle

Although the overall goals of the proposed action are expected to benefit the Pitcher's thistle, the means by which the Forest will achieve their goals may unavoidably cause adverse effects to this species. This analysis assesses the likelihood and magnitude of impacts that may result directly or indirectly from specific proposed management actions or from the long-term operation of management activities. Specifically, we assess the measurable and detectable responses of Pitcher's thistle exposed to the proposed management actions and the environmental impacts associated with the actions, and the likelihoods of the exposure and the consequent response occurring.

The program-level analysis lacks definitive temporal and spatial information for the specific management actions. Although the standard and guidelines assist with narrowing our scope of analysis by specifying timing and habitat restrictions, our analyses are necessarily broad. Thus, we identify both the range of possible responses and the most likely responses anticipated for each management activity. Many of the standards and guidelines significantly reduce the potential impacts for Pitcher's thistle, effectively neutralizing most potential negative responses. However, some potential for negative responses remain.

Appendix D deconstructs the actions in the proposed Plan. The table focuses on those proposed Plan actions and effects of most concern to listed species. The table identifies the proposed management actions and associated project elements, the environmental impacts resulting from these project elements, and the likely responses of individuals exposed to these environmental impacts. It also describes the anticipated effects to the affected population in terms of reproduction, numbers, and distribution. These tables were intended to be read in concert with the following effects analysis section.

We focus on the impacts to individual responses. We then look at how these individual responses affect the fitness of the population in which these individuals belong. Lastly, we assess how the anticipated changes, if any, at the population level will affect the fitness of the species rangewide.

The standards and guidelines that reduce exposure and responses are described in more detail in the Proposed Action section. It is important to emphasize that this effects analysis is predicated on the fact that all standards and guidelines will be fully implemented, as intended. If not, this analysis may no longer be valid.

- Range Management

The four active grazing allotments on the Forest are not within Pitcher's thistle habitat and dunes do not provide suitable grazing pasture or hay cutting material. We do not expect Pitcher's thistle to be exposed to any range management activities.

- Timber Management

All timber management activities are performed outside of dune habitats. We do not expect Pitcher's thistle to be exposed to any timber management activities.

- Watershed Management

Watershed management activities are prohibited in occupied or potential Pitcher's thistle habitat. We do not expect Pitcher's thistle to be exposed to any watershed management activities.

- Wildlife, Fish, and Sensitive Plant Management

Management actions for wildlife, fish, and sensitive plants for most species are not used in dune habitats and Pitcher's thistle will not be exposed to these activities. The Forest will undertake management activities as directed by the Pitcher's thistle Recovery Plan (USFWS 2002b). These activities include habitat protection measures, control of NNIS, habitat restoration (if necessary), surveys and monitoring, information and education programs, and research. We expect these actions to increase survivorship, enhance reproduction, and contribute to the recovery of Pitcher's thistle on the Forest.

- Minerals and Geology

Strict State and Federal laws regulate all resource extraction in dune habitats. Surface occupancy for resource extraction is prohibited under the following circumstances: 1) within 300 feet of Lake Michigan, 2) in State-designated Critical Dune habitat, and 3) in the Nordhouse Dunes Wilderness Area, and 4) in any occupied Pitcher's thistle habitat. These restrictions cover all Pitcher's thistle habitat on the Forest and we do not expect this species to be exposed to any minerals and geology management.

- Fire Management

Fire management activities on the HMNF are focused on areas with a high fuel hazard (i.e., forested areas) or are areas targeted for KBB habitat restoration. The Pitcher's thistle is not found in either of these habitat types. Wildfires (natural or human caused), while possible, are typically rare in dune habitats. Therefore, we do not expect Pitcher's thistle to be exposed to fire management activities.

- Transportation System

Currently, there are no roads for motorized use in the dune areas with Pitcher's thistle. Furthermore, roads are prohibited in the Nordhouse Dunes, in the Research Natural Area, and in dune habitats that provide habitat for the Pitcher's thistle. Roads that provide access into Pitcher's thistle habitat may indirectly impact this species by increasing human disturbance and introduction of invasive exotic species. However, these potential impacts have been greatly reduced or avoided because the Forest has eliminated road access into occupied Pitcher's thistle areas. Future impacts will be further minimized because there are only two indirect access points

that provide only foot traffic access. Any remaining potential for adverse impacts from introduction of NNIS will be addressed under recreation management, below. Therefore, we do not expect transportation management to have any measurable impacts on Pitcher's thistle.

- Forest Pest Management

Non-native invasive plant species are impacting Pitcher's thistle on the Forest, particularly spotted knapweed and Lombardy poplar. The Forest will control occurrences of problem exotic species using Integrated Pest Management techniques, including hand-pulling, cutting, and herbicide use. The Forest will minimize herbicide use to control of those NNIS where the current scientific literature indicates that other methods are ineffective or cost-prohibitive. Currently, Lombardy poplar fits into this category. In occupied habitat, the Forest can apply herbicides in a manner that ensures that exposure of individual Pitcher's thistle plants is extremely unlikely. Other methods such as hand-pulling and cutting will also be applied in a manner that does not directly harm Pitcher's thistle plants. However, despite all the precautions taken, there is a likelihood of some Pitcher's thistle plants being inadvertently trampled and crushed during NNIS control efforts.

- Recreation Management

Recreational activities are very popular in the dunes that provide habitat for the Pitcher's thistle. Specifically, plants are frequently exposed to camping and foot traffic (motorized vehicles are prohibited). The Forest restricts human activity in Pitcher's thistle habitat to designated camping areas and trail systems, but people commonly leave these designated areas and roam the dunes. Pitcher's thistle plants may be trampled or otherwise crushed by human traffic. In addition, some dunes may become eroded and denuded of vegetation because of heavy human activity. Furthermore, humans are a vector for establishment of NNIS, inadvertently carrying seeds or other plant materials in their equipment and clothing.

Potential negative impacts are most likely to occur in the Lake Michigan Recreation Area, which is home to the Cooper Creek Pitcher's thistle population. This area has concentrated visitor use and relatively few restrictions on recreational activities. The Nordhouse Dunes Wilderness Area, where the Big Sable population is located, is better protected under the strict regulations governing wilderness areas.

As previously discussed, the Forest will take measures to control NNIS. Furthermore, the proposed Plan includes numerous standards and guidelines to manage recreational activities in Pitcher's thistle, especially in the Nordhouse Dunes. In areas where they overlap, protections for the piping plover will benefit the Pitcher's thistle. These standards and guidelines effectively limit and guide recreational activities to avoid and minimize negative impacts by limiting foot traffic, posting signs with educational information, and increasing law enforcement to protect plants. However, negative impacts are still likely to occur and will have measurable impacts on the Pitcher's thistle populations.

Cumulative Effects

Cumulative effects include the combined effects of any future State, local, or private actions that are reasonably certain to occur within the action area covered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Potential cumulative effects could occur in the Au Sable Point Pitcher's thistle population and in the other areas of private ownership on the Manistee NF. Human activities, including development, recreation, and roads to the shoreline are present and may be expected to continue in these areas. If performed in Pitcher's thistle habitat, these activities may have a progressive negative impact on the species within the action area. The Au Sable Point population may be vulnerable to sand mining and other resource extraction activities because it is located on lands not protected by State (Critical Dune designation) or Federal (Forest restrictions) regulations. It is possible that resource extraction activities may adversely affect the Pitcher's thistle, however, as we have no evidence that these activities are reasonably certain to occur, we cannot factor such actions into our analysis of jeopardy for this species.

The development of privately-owned mineral rights is possible on both private and Forest Service lands. Mineral rights on Federal lands are subject to an environmental analysis, review, oversight, and permit from the Federal agency. The Federal agency, however, may not be able to condition a permit in a manner that would preclude the development of the resource. In such cases, the Forest may not be able to impose a "no surface occupancy" stipulation in the permit for mineral extraction in occupied habitat, and the species may be adversely affected. However, since there are no known mineral developments that are reasonably certain to occur, we cannot presently account for them into our jeopardy analysis for this species.

Conclusion

After reviewing the current status of the Pitcher's thistle, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Pitcher's thistle. No critical habitat has been designated for this species; therefore, none will be affected.

There are likely to be adverse effects to the Pitcher's thistle in the action area as a result of recreational activities. These adverse effects are expected to be in the form of habitat degradation and crushing or loss of individual plants, resulting primarily from foot traffic and camping. The Forest has committed to avoiding or reducing these impacts by limiting and managing recreational activities in dune habitats as necessary. We believe that, while this level of adverse effects remains, the proposed action taken together with cumulative effects is not reasonably expected to, directly or indirectly, reduce appreciably the likelihood of both the survival and recovery of the Pitcher's thistle in the wild by reducing the species' reproduction, numbers, or distribution within the action area.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act, as amended, prohibits any taking of listed species without special exemption. Sections 7(b)(4) and 7(o)(2) of the Act exempts taking that is incidental to and not intended as part of an agency's action, as long as that taking complies with the terms and conditions of an Incidental take statement.

Sections 7(b)(4) and 7(o)(2) of the Act, however, generally do not apply to listed plant species. Protection of listed plants is provided to the extent that the Act requires a Federal permit for removal or reduction to possession of endangered plants from areas under Federal jurisdiction, or any act that would remove, cut, dig up, or damage or destroy any such species on any other areas in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law. Regulations (50 CFR 17.71) extend protection to threatened plants as well, but with limitations. As Pitcher's thistle is currently listed as threatened under the Act, any take resulting from the proposed action would not require the Section 7(o)(2) exemption provided by an incidental take statement.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We believe that the Forest has already initiated or participated in important efforts to protect, manage, and increase our understanding of the Pitcher's thistle, including their commitment to implement the Conservation Measures in the proposed action. We offer the following Conservation Recommendations to further expand the knowledge of this species, and help better manage for the Pitcher's thistle in Michigan.

- Where appropriate, consider redesigning trails using measures such as markers, boardwalks, or other appropriate means to reduce the effects of recreational use, particularly foot traffic, on Pitcher's thistle populations and potential habitat.
- Take action to protect and improve habitat conditions and avoid or minimize adverse effects on Pitcher's thistle on private land within or adjacent to the Forest by a) adopting an education program which includes landowner contacts, b) seeking opportunities to develop information on presence of Pitcher's thistle on private land where owners are willing, and c) seeking opportunities, especially through partnerships, to help fund and carry out beneficial habitat management on private lands of willing owners.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

Bald eagle

The Forest has determined that the action being considered in this biological opinion is not likely to adversely affect the bald eagle. The following section discusses the status of the bald eagle, both on a range-wide basis and within the action area, and our evaluation of the determination for this species.

Status of the species

This section presents the biological or ecological information relevant to formulating the biological opinion. The purpose is to provide the appropriate information on the species life history, its habitat and its range-wide distribution and conservation status for analyses in later sections. This section also documents the effects of all past human and natural activities or events that have led to the current status of the species.

Species Description

The USFWS listed the bald eagle as endangered in 1967 under a precursor to the Endangered Species Act of 1973. Their status changed to threatened in 1978, which is their current status. Bald eagles are a large raptors, with adult plumage consisting of a white head and tail with a dark brown body. Juvenile eagles are completely dark brown and do not fully develop the majestic white head and tail until the fifth or sixth year. Fish are the primary food source but bald eagles will also take a variety of birds, mammals, and turtles (both live and as carrion) when fish are not readily available. Adults average about three feet from head to tail, weigh approximately 10 to 12 pounds and have a wingspread that can reach seven feet. Generally, female bald eagles are somewhat larger than the males.

Life History

Adult eagles mate for life and establish nesting territories to which they return each year. Nesting pairs may remain near their territory throughout the year, particularly toward the southern edge of the species' range and during mild winters. Northern pairs of bald eagles migrate south during the winter when rivers and lakes freeze. These birds tend to use locations where feeding opportunities are good and human disturbance is low.

The breeding season varies throughout the U.S., but typically begins in the winter for the southern populations and progressively shifts toward spring the further north the populations occur. The typical nest is constructed of large sticks and lined with soft materials such as pine needles and grasses. The nests are very large, measuring up to six feet across and weighing hundreds of pounds. Many nests are believed to be used by the same pair of eagles year after year. Female eagles lay an average of two eggs; however, the clutch size may vary from one to three eggs. The eggs are incubated about 35 days. The young fledge 9 to 14 weeks after hatching and at approximately 4 months the young eaglets are on their own.

Habitat

Because eagles primarily rely on fish as a food source during the breeding season, nests are always located near water, often within 120 feet of the shoreline (Hensel and Troyer 1964). Eagles usually select the largest, tallest trees in the vicinity in which to nest (Stalmaster 1987; Buehler et al. 1991). There are no specific size requirements for nest trees, but they tend to be very large, ranging from 60 to 180 feet tall. Eagles build their nests in the upper portion of trees, about 15 to 30 feet from the top (Mathisen 1968). Mature, tall trees provide an unobstructed view and are sturdy enough to support the nest which is large (up to 6 feet in diameter) and heavy. Trees with damaged tops are often used by eagles since they provide a good structure for a nest. In general, eagles rarely use trees which are located near human activity or development for nesting (Buehler et al. 1991).

Nests have been reported to last up to 40 years but usually last about 5 years (Stalmaster 1987) and are often destroyed by storms. Most eagle pairs build more than one nest in their territory. Additional nests may serve as insurance such that if the primary nest is destroyed, the breeding pair may still initiate a clutch of eggs for the season. Trees with unused nests still have value because the nest may be used in subsequent seasons.

In addition to nesting trees, perching trees also are important components of the eagle habitat. Perching trees are used by adults, and later in the season by young, for resting and viewing the territory and for hunting perches. Eagles spend more than 90 percent of their time perching (Stalmaster 1987). Perch trees, like nest trees, are usually large and are either close to water for feeding, or close to the nest for nest attendance and vigilance against predators. Perch trees may be live or dead, and most are isolated from other trees and have open branches. This accommodates the eagle's need for open space in order to take off and land.

Roost trees, in which eagles sleep at night, are also important components of eagle breeding and wintering habitat. Characteristics of these trees are similar to those of perch trees, although they do not need to be near water. They are large, living or dead, with open horizontal branches. Roosts provide a place for shelter from wind, rain, or snow, and bare branches provide a place to warm up in the morning sun. Both perch and roost trees are selected only if they are free from heavy human disturbance.

Wintering habitat for bald eagles is composed of three critical components: feeding areas, daytime perches, and night roosts. Feeding areas are usually open water areas on rivers, often below locks, dams and power plants, or at other areas where there is open water, allowing them to feed on waterfowl and fish. Bald eagles will also feed in upland areas where they can find livestock carcasses or game animals to feed upon (Martell 1992). Daytime perches are found near the foraging areas, and are often within 100 feet of the water's edge. These perches are used for hunting, feeding, and resting.

Distribution, Status, and Threats

The bald eagle is a North American endemic species that was once widespread throughout North America, but has declined over the past two centuries (Stalmaster 1987). The bald eagle

historically ranged throughout North America except extreme northern Alaska and Canada, and central and southern Mexico. Prior to 1940, the eagle population began to decrease due to the decline in numbers of prey species, as well as direct killing and loss of habitat. In 1940, the Bald Eagle Protection Act was passed which made it illegal to kill, harm, harass, or possess bald eagles, alive or dead, including eggs, feathers and nests. As a result of the passing of this law, the bald eagle began to partially recover. However, subsequent to World War II, the use of dichloro-diphenyl-trichloroethane (DDT) to control mosquitoes became very widespread along coastal and wetland areas. This had a drastic effect on the bald eagle, and as a result of foraging on contaminated food, the species' population plummeted. The decline continued until DDT was banned from use in the United States on December 31, 1972.

After the Endangered Species Act was passed in 1973, the bald eagle was listed as endangered throughout the lower 48 states, except in five states, Michigan, Minnesota, Wisconsin, Washington, and Oregon, where it was listed as threatened. Based on geographic location, the Service established five recovery regions. The five regions are as follows: Northern States, Chesapeake Bay, Southeast, Southwestern, and Pacific

The Northern States Bald Eagle Recovery Plan (USFWS 1983; NSBERP) has directed the management and recovery of the bald eagle since 1983. The primary objective of the NSBERP is to reestablish self-sustaining populations of bald eagles in suitable habitat throughout the Northern States Region. Protection of active nest sites is central to the NSBERP.

Through implementation of the tasks and priorities included in each recovery region; strict enforcement of the Act; and the banning of DDT, the bald eagle population has dramatically increased. The bald eagle's population growth has exceeded most of the goals established in the recovery regions and recovery continues to progress at an impressive rate. In 1998, the nesting population in the lower 48 States constituted more than a tenfold increase from the known population level in 1963 (USFWS 1999). The breeding population in 1998 exceeded 5,748 occupied breeding areas. The bald eagle population has essentially doubled every 7 to 8 years during the past 30 years. Furthermore, recovery has been broadly distributed throughout the bald eagle's range. In 1984, 13 states had no nesting pairs of bald eagles. By 1998, all but 2 of the lower 48 States supported nesting pairs. In 1999, the USFWS proposed to delist the bald eagle. To date, however, the species has yet to be delisted.

Summary and Synopsis of the Species Status

Through implementation of the recovery tasks and priorities; strict enforcement of the Act; and the banning of DDT, the bald eagle population in the U.S. has dramatically increased. The bald eagle's population growth has exceeded most of the goals established in the recovery regions and recovery continues to progress at a remarkable rate. By 1998, the nesting population in the lower 48 States constituted more than a tenfold increase from the known population level in 1963 with nesting pairs in all but 2 of the lower 48 States. The breeding population in 1998 exceeded 5,748 occupied breeding areas. In 1999, the USFWS proposed to delist the bald eagle. To date, however, the species has yet to be formally delisted.

Environmental Baseline

This section describes the species status and trend information within the action area. It also includes State, tribal, local, private actions already affecting the species or that will occur contemporaneously with the proposed action. Unrelated Federal actions that have completed formal or informal consultation are also included in the environmental baseline.

Status and Distribution of the Species in the Action Area

In Michigan, the bald eagle probably historically nested throughout the state, wherever suitable habitat existed (Brewer and McPeck 1991). By the late 1950's the species was an "uncommon summer transient". The first state-wide surveys in Michigan documented low numbers of bald eagle nesting in the state. In 1961, only 54 occupied nests were observed; these nesting pairs produced 35 young, 22 of which were successfully fledged. Declines continued through the 1960's and leveled off in the 1970's, remaining near 86 breeding pairs. The eagle population began to increase in 1981 and by 1988 162 pairs were located (Brewer and McPeck 1991). The 2005 statewide bald eagle survey documented 459 occupied nests producing 452 successfully fledged (USFWS unpubl. data). These numbers reflect the significant improvement in status of bald eagles in Michigan.

Bald eagles are present on the Forest as breeders and occasionally as winter residents. The Forest began monitoring its bald eagles in 1960, in cooperation with the National Audubon Society's Continental Bald Eagle Project. In 1977, the Michigan Department of Natural Resources (MDNR) began assisting with surveys. Monitoring efforts have continued to today.

Bald eagle populations on the Forest have increased steadily and markedly (Table 12). In 1961, there were eight active territories, four of which successfully produced six fledglings. In 2004, 54 breeding territories were identified within or near the Forest.

Table 12. Bald Eagle Breeding Territory Data for the Huron-Manistee National Forests.

Year	# of Territories	# Territories Active	# Fledged	Average/Territory	Average/Active Territory
1961	8	4	6	0.75	1.50
1971	9	4	5	0.55	1.25
1981	11	4	6	0.54	1.50
1986	9	6	9	1.00	1.50
1991	20	11	15	0.75	1.36
2001	49	49	56	1.14	1.14
2004	54	45	45	.833	1.0

Factors Affecting The Species Environment Within The Action Area

On the Forest, various land management practices potentially affect the bald eagle. These practices primarily include timber harvest, recreation, roads and trails, and other human developments. Further, developments by other landowners or agencies within the boundaries of the Forests (on other ownerships or by authorization on National Forest System land) may affect

bald eagles. The factors affecting the bald eagle, as discussed in the Forest's BA, are detailed below in the primary categories of influence.

1. Aquatic and Terrestrial Habitat

As directed in the NSBERP, the Forests' bald eagle habitat has been managed under their Bald Eagle Management Plan (USFS 1986; BEMP) since 1986. The BEMP designated essential habitats for bald eagle breeding areas on the Forest. The Huron Forest has seven breeding areas identified along the Au Sable River, four near complexes of lakes, one along the shoreline of the Great Lakes, and one along a smaller stream. The Manistee Forest has twelve identified along rivers, one near a large lake, and one with smaller lakes and wetlands. The BEMP emphasizes protection and maintenance of bald eagle breeding areas when combined with other appropriate or proactive habitat management. The BEMP also provides for current and future potential essential habitat areas where large contiguous areas of habitat remain suitable and are not just small, specific sites where nests are currently located. To date, approximately 60% of the existing territories within the Forest are located within the designated essential habitat breeding areas. The next section (Human Disturbance) discusses the BEMP and how it protected bald eagle nesting habitat.

Records of bald eagle territories within the Forests are typically associated with major rivers and streams, Great Lakes shorelines, lakes, deep marshes, or clusters of smaller lakes and streams. Large older conifers, primarily white pine, are favored for nest and perch trees over much of the range. On the Forests, aspen and, to a lesser degree, red pine is also utilized.

In the winter, Bowerman (1991) found that adult bald eagles appear to utilize the Au Sable, Manistee, and Muskegon Rivers within or near the Forests, where they appear to be resident throughout the year. Adults utilize coniferous perches that are farther from human disturbance than the predominately deciduous perches of immature bald eagles. Immature bald eagles appear to over-winter in greater numbers on the Muskegon River, particularly the Muskegon State Game Areas and Muskegon Lake. Individuals can be seen where there is open water and where fish may be available, typically in late fall/early winter and again in early spring. Scattered individuals are occasionally seen elsewhere in the winter and are probably subsisting on carrion.

The Forest has significant aquatic resources. There are approximately 1,500 lakes totaling about 17,000 surface acres within the proclamation boundary. There are four major river basins that have their headwaters within the Huron National Forest boundary, the Au Sable, Pine, Au Gres, and Tawas Rivers. There are eight major river basins within the Manistee National Forest, the Manistee, Little Manistee, Pine, Big Sable, Pere Marquette, Pentwater, Muskegon, and White Rivers. These total approximately 3,364 miles of rivers and streams within the Forest's proclamation boundary.

A few of these major river systems have multiple hydroelectric impoundments. There are ten hydro-electric impoundments within the Forests' proclamation boundaries. They include two on the Muskegon River, two on the Manistee River, and six on the Au Sable River. The impoundments range from 200 to 3,000 surface acres in size. These dams are under the authority

of the Federal Energy Regulatory Commission and regulations of such dams are beyond the jurisdiction of the Forest Service.

These hydroelectric facilities have had significant impacts on the riverine ecosystems. Dams on large rivers, along with smaller impoundments on private lands and numerous road stream crossings, have resulted in a fragmented aquatic habitat for fish species such as brook trout and mottled sculpin. The impoundments have also increased water temperatures, reduced sediment loads, and altered hydrology.

However, the hydroelectric facilities have also had significant positive effects on the bald eagle. The impoundments provide prime open water habitat for bald eagle foraging and breeding habitat. Several of the bald eagle nests on the Forest are focused around these impoundments. In addition, the dams have served as barriers, preventing contaminated fish from moving from the Great Lakes to inland rivers and streams. While removal of the dams would increase connectivity in the riverine systems and would likely improve the status of some fish species, it would also allow the proliferation of contaminants into the upstream food chain, ultimately reaching bald eagles.

2. Human Disturbance

Eagle response to and tolerance of disturbance varies (USFWS 1983). While not generally known to be affected by low degrees of human disturbance, numerous studies indicate that bald eagle habitat quality declines as human disturbance increases (Grubb et al 1992). Human disturbance can affect eagles by 1) physically harming or killing eggs, young, or adults, 2) altering habitats, and 3) disrupting normal behavior. Bald eagles are most susceptible to human disturbance during egg laying, incubation, and the early nestling period (USFWS 1983). Human disturbance results from forest harvest (including road building to access harvest sites), recreation (on water or land, motorized and non-motorized), illegal acts (such as shooting or poisoning), and trauma (such as collision with vehicles, powerlines).

Being in close proximity to Detroit and Chicago, northern Ohio, and Indiana, the Forests receive considerable year-round recreational use (USFS 2005b). Recreational uses include hiking, hunting, fishing, camping, canoeing, boating, operating personal watercraft, recreational driving, mountain biking, motorcycling, off-road vehicle and snowmobile use.

Overall, the Forest is subject to a high degree of human disturbance. Numerous OHV trails and roads provide human access to much of the Forest. To help minimize potential adverse effects during the breeding season, trails and roads are closed, as necessary, in bald eagle breeding territories. Most of the lakes on the Forest are open to motorized use, which may disturb bald eagles. Some of the Forests' river systems are major destinations for anglers and canoeists. In particular, both the river and impoundment sections of the systems with hydroelectric facilities are major draws for recreationists.

The Forest protects bald eagle nesting areas as outlined in the NSBERP and BEMP. These measures ensure an activity buffer around each nest so that timber harvest, recreation, or other

potentially disturbing activities does not occur during sensitive breeding times within that buffer. This has helped to avoid or minimize potential adverse impacts on bald eagles.

Nest sites are protected with three zones, as follows (P. Huber, USFS, pers. comm. 2006):

- Primary Nest Zone: 330 feet from nest
- Secondary Zone: 330 - 660 feet from nest
- Tertiary Zone: 660 - 1320 feet from nest

Primary Zone: All land use except that necessary to protect or improve the nest site will be prohibited in this zone. Human entry will be prohibited during the most critical (February 1 – April 1) and moderately critical (April 1 – July 15) periods, unless performed in connection with bald eagle research or management by qualified individuals. Motorized access into this zone will be prohibited. Other human intrusions prior to September 1 would be controlled unless related to bald eagle research or management activities.

Secondary Zone: Land-use activities that result in significant changes in the landscape such as clearcutting, land clearing, or major construction, would be prohibited. Actions such as thinning tree stands or maintenance of existing improvements can be permitted, but not during the most critical and moderately critical periods. Roads and trails in this zone would be obliterated, or closed during the most and moderately critical periods. Other human intrusion prior to September 1 would be controlled unless related to bald eagle research or management activities.

Tertiary Zone: This is the least restrictive zone. Most activities would be permissible in this zone, except during the most critical period, when activities would be restricted in a manner similar to that outlined for the secondary zone.

The BEMP also provides protection to remnant nests in unoccupied territories for five years, within 330 feet of the nest. Destroyed nests will also be protected within 330 feet when the territory is occupied to ensure the long-term sustainability of remnant nests and nest sites. The BEMP protects potential nesting areas by restricting development of roads, trails, timber harvest and any other habitat alteration or disturbance activities. Other management guidelines that address habitat suitability include:

- Minimum essential breeding habitat to be 640 acres (2.8 km²) (A territory averages 1-2 km² [Stalmaster 1987]).
- Nesting habitat should occur within 1.5 km of foraging habitat.
- Older, uneven-aged forest should predominate in the upland area surrounding the nest.
- In potential nesting areas there should be at least 4-6 super-canopy trees (white or red pine in the Huron-Manistee National Forests) per 320 acres (128 ha) within 1320 ft (400 m) of a river or lake over 40 acres (16 ha). There should also be >3 super-canopy trees, preferably dead or with dead tops within .25 mi (400 m) of each nest tree.

As previously discussed in the Environmental Baseline section for the KBB, the Forest participates in control of gypsy moths. This activity has the potential to impact bald eagles through disturbance by aerial application of pesticides. However, before flights, all known bald

eagle nests are identified and avoided during operation so that any potential adverse impacts are undetectable.

Summary and Synthesis of the Environmental Baseline

Bald eagles are present on the Forest as breeders and occasionally as winter residents. As of 2004, there were 54 breeding territories identified within or near the Forest. Currently, both nesting and foraging habitat for bald eagles appear to be abundant on the Forest. The steady increase in active eagle territories attests to the quality of habitat on the Forest. In addition, the nest protection zones and other measures identified in the NSBERP and BEMP have provided ample protection for the bald eagle essential habitat on the Forest. However, much of the Forest is subject to a high degree of human disturbance via roads, trails, and lake access. Human activities, especially recreation, undoubtedly affect bald eagles on the Forest.

Effects of the Action

This section assesses the effects of the proposed action, including the direct and indirect effects together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). We are not aware of any actions that are interdependent or interrelated to the proposed action being considered in this biological opinion.

Analysis for the Effects of the Action

Effects of the Forest Plan Goals, Objectives, and Desired Conditions on the bald eagle

The proposed Plan emphasizes habitat necessary to sustain minimum viable populations that represent existing native vertebrates throughout the Forest. Maintenance and improvement of populations of endangered, threatened, or sensitive species will continue to be a Forest priority. For the bald eagle, the Forest will manage for conditions that will maintain current nesting territories and provide protection for foraging sites. The proposed Plan also puts significant emphasis on development of future roosts to maintain an adequate supply for the bald eagle population. The proposed Plan emphasizes management for late seral stages through natural successional processes in riparian zones, focusing on retention of a of trees to protect water quality and provide a source of recruitment for large woody debris to the adjacent aquatic system. The proposed Plan directs a net reduction in the miles of roads on the Forest by emphasizing closures of roads determined to be non-essential for resource management.

The proposed Plan directs that recovery plans for listed species, including the bald eagle, be implemented. The proposed Plan also ensures that partnerships will continue by directing cooperation and coordination with responsible government and land and resource management agencies, tribes, and partners regarding endangered, threatened, and sensitive species.

We believe that the overall goals, objectives, and desired conditions of the proposed Plan are consistent with the ecological needs of the bald eagle. We expect that implementation of this plan will protect and manage for viability bald eagles on the Forest.

Effects of Specific Management Actions on the bald eagle

Although the overall goals of the proposed action are expected to benefit the bald eagle, the means by which the Forest will achieve these goals may unavoidably cause adverse effects to the species. This analysis assesses the likelihood and magnitude of impacts that may result directly or indirectly from specific proposed management actions or from the long-term operation of management activities.

The program-level analysis lacks definitive temporal and spatial information for the specific management actions. Although the standard and guidelines assist with narrowing our scope of analysis by specifying timing and habitat restrictions, our analyses are necessarily broad. Thus, we identify both the range of possible species responses and the most likely responses anticipated for each management activity. Many of the standards and guidelines significantly reduce the potential impacts for bald eagles, effectively neutralizing most potential negative responses. However, some potential for negative species responses remain.

Appendix E deconstructs the actions in the proposed Plan. The table focuses on those proposed Plan actions and effects of most concern to listed species. The table identifies the proposed management actions and associated project elements, the environmental impacts resulting from these project elements, and the likely responses of individuals exposed to these environmental impacts. It also describes the anticipated effects to the affected population in terms of reproduction, numbers, and distribution. These tables were intended to be read in concert with the following effects analysis section.

We focus on the impacts to individual fitness responses (in particular, effects on individual annual and life-time survival rates and annual and life-time reproductive potential). Once we anticipate the individual fitness responses, we then look at how these individual responses affect the fitness of the population in which these individuals belong. Lastly, we assess how the anticipate changes, if any, at the population level will affect the fitness of the species rangewide.

The standards and guidelines that reduce exposure and responses are described in more detail in Proposed Action section. It is important to emphasize that this effects analysis is predicated on the fact that all standards and guidelines will be fully implemented, as intended. If not, this analysis may no longer be valid.

- Range Management

There are no grazing allotments within essential bald eagle habitat on the Forests. Grazing allotments generally occur in old farmsteads and open areas in upland habitats that the Forest has acquired through land adjustments. Trees on the edges of grazed areas may serve as perching sites. Eagles may also forage in grazed areas. While some eagles may enjoy increased foraging

opportunities, the small area of pasture on the Forest likely does not measurably impact eagles on the Forest.

- Minerals and Geology

All minerals and geology activities will contain a no-surface occupancy stipulation for areas within 1,320 feet of a bald eagle nest. Thus, no bald eagle nesting territory should be exposed to these activities. Outside of the nesting territories, minerals and geology activities do not occur near aquatic habitats, so while bald eagles may be exposed to these activities, they should not have any measurable impacts.

- Forest Pest Management

Overall, aggressive control of invasives on the Forest should increase biodiversity and improve ecosystem function. This may improve bald eagle nesting or foraging habitat and increase survival and breeding success on the Forest. In addition, all pest control activities will observe the activity restrictions near active bald eagle nests during the breeding season, avoiding most direct exposure.

Mechanical control (hand pulling, cutting, digging) will be used to combat of invasive plants on the Forest. While these activities may result in increased noise, human presence, and physical disturbance, these impacts will be short-term, temporary, and localized in nature. Most of these activities are focused on small weeds (e.g., spotted knapweed) and shrubby trees (e.g., buckthorn) and their removal should not affect the character of bald eagle habitat. Human disturbance should be minimal because these activities do not require the use of large equipment. Any potential bald eagle response from exposure to mechanical control is expected to be minor and should not have any detectable impacts on individuals.

The only type of biological control that has been used on the Forest thus far is the release of beetles to control purple loosestrife. The use of beetles will open up wetlands that are currently clogged with purple loosestrife, and prompt the return of native plants and their associated aquatic fauna. While the proposed Plan allows for other types of biological control to be used, none are currently anticipated. We expect that biological control will be used very sparingly and should have no measurable impact on bald eagles.

Pesticides will also be used sparingly on the Forest for vegetative management, fisheries management, or to suppress insects and disease infestations when their use is cost efficient, biologically effective, and environmentally acceptable. The Forest will protect aquatic habitats and other sensitive areas by establishing untreated zones adjacent to water bodies and other sensitive areas, where necessary. Thus, we do not expect any detectable adverse impacts to bald eagles on the Forest.

- Watershed Management

As described in the Status of the Species section, aquatic habitats provide the majority of bald eagle roosting and foraging sites. Watershed management activities include general habitat

management and stream/riparian management and restoration designed to improve the condition of aquatic habitats on the Forest. General watershed management includes application of BMPs to minimize potential impacts near aquatic habitats, such as maintaining buffer strips, restricting potential contaminants (i.e., fuel, oil) near waterbodies, and planning roads to minimize erosion. Stream and riparian habitats will be protected within the Streamside Management Zones, which will minimize disturbance and protect water quality. In addition, the Forest will continue with its stream restoration program. Proposed restoration of large woody debris in stream channels, along with stream bank stabilization, gravel and cobble placement for spawning habitat, and fine sediment removal, will improve the health of aquatic habitats on the Forest. We expect all of these activities to result in improved function of aquatic ecosystems. This should enhance bald eagle foraging opportunities by contributing to improved fisheries. In addition, riparian protection and emphasis of old-growth characteristics in riparian zones should facilitate development of roosting and perching sites. This may further improve foraging habitat and increase and expand potential breeding sites. As a whole, this may improve survivorship and breeding success of bald eagles on the Forest.

The Forest will also continue to cooperate with FERC on operation of the ten major hydroelectric facilities within the Forest boundaries. These facilities impact stream habitats through fragmentation and replacement of sections of stream habitat with impoundments. Fragmentation may actually protect bald eagles by restricting contaminated Great Lakes fish from moving upstream. In addition, maintenance of open water impoundments will sustain important foraging opportunities for bald eagles. We believe that the hydroelectric facilities have and will continue to improve survivorship and breeding success of bald eagles on the Forest.

- Wildlife, Fish, and Sensitive Plant Management

There are a variety of activities completed under this management activity. Note that many actions that will improve habitat or otherwise benefit species on the Forest are expressed as standards and guidelines for other management activities, and will not be discussed here. Management of wildlife openings will be discussed, as appropriate, under Fire and Timber Management below. Some wetlands with fish provide foraging habitat for bald eagles. Thus, management activities that maintain or improve these habitats should sustain bald eagles, improving breeding success and survivorship.

Management that affects deer habitat may have varying impacts on bald eagles. Some vegetation prescriptions that provide deer habitat will increase under the proposed Plan (e.g., barrens creation), potentially causing localized increases in deer numbers. Increasing deer populations may result in more deer-vehicle collisions. Although bald eagles tend to specialize on fish, they are opportunistic scavengers and will readily forage on deer carrion. Increased deer kills in an area may provide greater foraging opportunities and improve the reproductive success and survival of the local eagles. However, eagles feeding on roadsides are then vulnerable to collisions themselves, which may cause injury or, more often, death of individuals. See the Transportation Management section for an analysis of this potential impact.

As previously discussed in the Environmental Baseline section, the Forest manages its bald eagle population following the NSBERP and BEMP. These documents include designation and

management of essential habitat and strict management and protection zones around nesting sites. We expect these actions to increase survivorship, enhance breeding, and contribute to the recovery of bald eagles on the Forest.

- Fire Management

On the Forest, bald eagles do not tend to occupy fire-adapted habitats. Thus, we do not expect that they will be exposed to most fire management activities. Specifically, most prescribed burning, fuel breaks, and line control should not occur in bald eagle habitat. Overall, the reduction in frequency and intensity of wildfires should not have a measurable impact on bald eagles.

Some prescribed burning activities may indirectly impact bald eagles. Prescribed burning may create snags that serve as future roosting sites. However, given that most burning activities occur outside of typical bald eagle habitat, loss of a few potential roost trees is not expected to have a detectable impact on the Forest's bald eagle population. Bald eagles may be exposed to smoke from prescribed burning that drifts into their habitat. However, the Forest will adhere to the nest protection zones that will avoid impacts to nesting sites. We expect that bald eagles exposed outside of the nesting season should be able to avoid drifting smoke without any measurable negative response.

Bald eagles may be exposed to aerial detection and control of wildfires. The primary concern for adverse impacts is at the nest. However, the Forest will avoid nesting areas and observe the protective zones. Outside of the nesting area, bald eagles are highly maneuverable and should be able to avoid aerial activity without any measurable negative response. The sporadic nature of wildfire control further limits potential impacts. We expect that most aerial activities will have only small, undetectable impacts on bald eagles.

- Vegetation Management

Aquatic and terrestrial wildlife habitats and species populations, while constantly changing due to management activities and naturally-occurring events, are present in amounts, quality, distributions, and patterns so that Forest Service lands contribute to the conservation and recovery of the bald eagle. The proposed Plan incorporates measures from the BEMP that protect and enhance bald eagle essential habitat on the Forest. The nest protection zones around nests limits direct exposure to chicks and adults as they engage in nesting activities. The protections provided for areas, such as remnant nests, potential nest sites, and historic breeding areas, will ensure that other potential adverse impacts of timber management on the Forest's bald eagles will be unmeasurable. Furthermore, these measures will improve the quality of current and future breeding and foraging habitat on the Forest and should improve bald eagle survival and breeding success.

- Transportation Management

Many roads of varying classification levels are found in bald eagle essential habitat. Appendix E outlines the environmental impacts that may result from roads. Some impacts, such as habitat

fragmentation and spread of NNIS, are not expected to occur at a scale that will have measurable impacts on bald eagles. The standards and guidelines should reduce other impacts, such as loss of forested habitat and noise and physical disturbance, to a point where they will be undetectable. In particular, the BEMP requirement for all roads within 1,320 feet of a nest site to be closed during the nesting season makes direct exposure to nesting activities extremely unlikely and significantly reduces potential impacts where exposure does occur. Furthermore, the proposed Plan includes plans to decrease the miles of roads on the Forest. This will further decrease the potential for human-related disturbance where road closures intersect with essential habitat.

Although bald eagles tend to specialize on fish, they are opportunistic scavengers and will readily forage on road-killed deer. Increased deer kills in an area may provide greater foraging opportunities and improve the reproductive success and survival of the local eagles. However, eagles feeding on roadsides are vulnerable to collisions themselves, which may cause injury or, more often, death of individuals. The collisions are most likely occur on the larger state and Federal highways within or adjacent to the Forest where traffic moves in greater volumes and at higher speeds. Thus, bald eagle-vehicle collisions are unlikely to occur on Forest Service roads.

- Recreation Management

Many recreational activities may occur in bald eagle essential habitat. Appendix E outlines the environmental impacts that may result from recreation management. Some impacts, such as habitat fragmentation and spread of NNIS, are not expected to occur at a scale that will have measurable impacts on bald eagles. The primary concern regarding recreational impacts to bald eagles is the noise and physical disturbance from human presence. Disturbance may come from a variety of recreational activities, such as snowmobile/OHV use, hiking, or canoeing/boating.

Outside of nesting territories, noise and physical disturbance recreational activities should not have any adverse impacts on bald eagles. While bald eagles may avoid specific locations where recreational activities are concentrated (e.g., campgrounds), particularly during times of heavy use, these areas comprise a small amount of the total habitat area available to eagles at any given time on the Forest. We expect that bald eagles outside of nesting territories would be able to avoid these activities without any measurable negative impacts.

Noise and physical disturbance from recreation inside of nesting territories may adversely impact bald eagles. Under these circumstances, adults, juveniles, and chicks may be exposed to recreational activities. Human activity may cause sufficient noise and physical disturbance to decrease the foraging success of adult or juvenile eagles or cause them to abandon their nest altogether. While adults or juveniles would likely relocate with minimal fitness repercussions, these responses could result in the death of eggs or chicks.

Bald eagle nesting territories tend to occur near large water bodies and rivers. On the Forest, these areas are especially popular for recreational activities such as angling, hiking, canoeing, boating, and camping. Recreational users may access nesting territories via boat launches, roads, and trails. The greatest potential for disturbance is from motorized use, including OHVs, snowmobiles, and boats. Snowmobiles are of particular concern, since use may occur during the most critical time period (March 1 – April 15), when eagles are most likely to abandon the nest.

However, the proposed Plan includes standards that implement the NSBERP and direct protection of nesting habitat during the breeding season. These standards will enforce the nest protection zones to avoid direct exposure to chicks and adults as they engage in nesting activities. Furthermore, they direct that recreational management activities within the nesting territories be designed to maintain or improve habitat. We expect that under most circumstances, these standards will reduce potential impacts to a point where they will be undetectable.

Although standards and guidelines will prohibit many recreational activities within the nest protection zones during the breeding season, some activities are more difficult to control. The Forest has only limited ability to restrict aquatic-based activities by closing parts of lakes or sections of rivers that are in nest protection zones. In some situations, area closures may be logistically infeasible. In addition, some individuals are likely to ignore the area closures (aquatic or terrestrial) and engage in potentially disturbing activities within the nesting zones. In especially remote areas, closures may be very difficult to enforce. Under these circumstances, bald eagles are likely to be exposed to recreational activities that may cause adverse impacts.

The Forest has managed its bald eagle population following the NSBERP since the last Forest Plan was signed in 1986. Since that time, the bald eagle population on the Forest has increased. Therefore, while recreational activities may cause localized, short-term decreases in reproduction and numbers, we do not expect that they will occur at a level that will significantly decrease the range, numbers, or reproduction of the bald eagle population on the Forest.

Cumulative Effects

Cumulative effects include the combined effects of any future State, local, or private actions that are reasonably certain to occur within the action area covered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Although we are aware of no major non-Federal actions that are reasonably certain to occur within the action area, it may be expected that some activities, particularly on private lands, could have a progressive negative effect on bald eagles in the action area. Human populations in the counties with bald eagles have been rapidly increasing in recent years (USDAFS 2003a). Human population growth is typically accompanied by increased urbanization, including road construction and land development. Both of these activities could result in the permanent loss of bald eagle habitat and cause disturbance to individuals or nesting pairs. Additional actions performed on private lands that may adversely affect the bald eagle in the future are application of pesticides and timber harvest.

Broad-scale aerial application, such as Bt spraying for Gypsy moth, has the potential to directly affect bald eagles through disturbance. However, the USFWS consults with the Forest Service's State and Private Forestry Forest Health Division on each treatment season to set timing and distances from nest sites that activities may occur in order to avoid direct adverse effects to eagles.

The development of privately-owned mineral rights is possible on both private and Forest Service lands. Mineral rights on Federal lands are subject to an environmental analysis, review, oversight, and permit from the Federal agency. The Federal agency, however, may not be able to condition a permit in a manner that would preclude the development of the resource. In such cases, the Forest may not be able to impose a “no surface occupancy” stipulation in the permit for mineral extraction in bald eagle habitat, and the species may be adversely affected. However, since there are no known mineral developments that are reasonably certain to occur, we cannot presently account for them into our jeopardy analysis for this species.

Conclusion

After reviewing the current status of the bald eagle, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the bald eagle. Critical habitat for this species has not been designated, therefore no destruction or adverse modification of that critical habitat is anticipated.

The bald eagle population on the Forest has steadily increased over the past 40 years, particularly since 1986, when the Forest first implemented its BEMP. The proposed Plan will continue the proactive and protective management of bald eagles as outlined in the BEMP. While some activities, specifically recreation, may cause localized decreases reproduction and numbers, we do not expect that they will occur at a level that will significantly decrease the range, numbers, or reproduction of the bald eagle population on the Forest. We conclude that the proposed action is not expected to, directly or indirectly, reduce appreciably the likelihood of both the survival and recovery of this species in the wild by reducing their reproduction, numbers, or distribution.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

In general, an incidental take statement (ITS) specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are

necessary to minimize the impacts of the take and sets forth terms and conditions which must be complied with in order to implement the reasonable and prudent measures.

Amount or Extent of Take

This ITS evaluates the incidental take of bald eagles that may result from implementation of the proposed Plan. The standards and guidelines within the proposed Plan significantly reduce the potential for adverse effects and incidental take to occur. In fact, we anticipate that the standards and guidelines will effectively avoid adverse impacts and incidental take from individual future projects. In other words, we do not anticipate future projects completed under the proposed Plan will cause adverse impacts or incidental take of bald eagles. However, we do anticipate that, over this planning period, the cumulative impacts of general management in the Forest's bald eagle habitat will cause some adverse effects and incidental take of the species. We further believe that we have sufficient information regarding potential for take over the life of the proposed Plan to anticipate it in this Plan level ITS, as described below.

This section addresses only a subset of the adverse effects analyzed in the Effects Analysis section. Specifically, we identify the effects that will: 1) rise to the level of take and are reasonably certain to occur, and 2) are within the action agency's discretion. Thus, adverse effects that not expected to rise to the level of take, are not reasonably certain to occur, or are not under the jurisdiction of the action agency are not analyzed in this ITS.

Recreation management may adversely impact bald eagles on the Forest. The standards and guidelines in the proposed Plan for managing habitat, along with protection of nesting territories, will be very effective at controlling impacts from recreation. However, potential for some adverse impacts remains from 1) violations of closed areas around nests and 2) insufficient protection of nests where area closures are difficult or not practical to implement. Thus, while the proposed Plan implements many standards and guidelines to minimize potential impacts, take from recreation management is still reasonably certain to occur. Any take that occurs under scenario 1 from illegal activities is outside the jurisdiction and authority of the Forest Service and not exempted by this Incidental Take Statement and therefore not the responsibility of the Forest Service. The remainder of this ITS addresses take from scenario 2.

We anticipate situations where some nests may be more difficult to provide protection. Specifically, nests that have developed camping areas in their territories and nests that are adjacent to lakes and rivers popular with recreationists may be exposed to high levels of recreational use. Under most circumstances, the Forest does not anticipate shutting down developed camping areas or closing off sections of rivers or lakes to recreational use. Under these circumstances, disturbance of pairs may cause them to permanently or temporarily abandon their nests. Temporary abandonment leaves eggs and chicks exposed to predation and interrupts incubation. This may cause the death of eggs or chicks. Permanent nest abandonment is also likely to cause the death of eggs and chicks.

There are multiple reasons for bald eagle nests to fail, including recreational disturbance, non-recreational disturbance (e.g., airplanes, human development), contaminants, natural causes (e.g., weather, food shortages). The primary cause for most nest failures is believed to be natural

causes, responsible for approximately 50% of all known nest failures (D. Best, USFWS, pers. comm. 2005). Of the remaining potential causes, recreational impacts are the most pervasive especially on the Forest, and most likely to cause nest failures. Given this, we estimate that recreational disturbance is responsible for approximately 35% of all known nest failures (D. Best, USFWS, pers. comm. 2005).

In Michigan, the overall rate of bald eagle nest failure between 1976 and 2005 was approximately 39% (USFWS, unpubl. data, 2005). We expect that the rate of nest failure on the Forest will remain steady over this planning period. As previously stated, recreational disturbance is estimated to be responsible for 35% of known nest failures. However, given the intense recreational pressure on the Forest, we anticipate that recreation alone may be the cause of more nest failures, likely approaching 45%. Although it's impossible to predict, based on this analysis, we estimate that the failure rate due to recreation on the Forest will not exceed 17% (or approximately 45% of 39%).

However, as evidenced by increasing populations over the past 40 years, the Forest is typically successful at implementing and enforcing bald eagle nest protection zones. In addition, some eagles have become habituated to some levels of human activity. Thus, the percent of nest failure at any given time will likely be much lower than this. This is not to say that we expect 17% of nests to fail in any given year, but merely that of those nests that are known to fail, no more than 17% should be caused by recreational disturbance.

The Forest will monitor and document the number of bald eagle nests that fail on an annual basis. Where nests are known to have failed for reasons outside of recreation or other activities beyond the Forest's control, they will not be counted towards the 17% take exemption.

Effect of Take

In the accompanying biological opinion, we determined that the proposed action is not likely to jeopardize the continued existence of the bald eagle. Therefore, we have determined that the level of anticipated incidental take associated with the actions completed under the proposed Plan is not likely to jeopardize the bald eagle. Some recreational activities that occur within essential habitat during the breeding season may cause sufficient disturbance to impair adult foraging activity or cause them to abandon their nest. This may result in the death of those eggs and chicks. However, the Forest has extensive standards and guidelines that strictly limit any activity, including recreation, in essential habitat, significantly reduce the potential for disturbance to occur. In general, we expect the proposed Plan to provide ample protection for the Forest's bald eagle population.

Reasonable and Prudent Measures

We believe that the following Reasonable and Prudent Measures should be applied to minimize the effect of incidental take that may result from implementation of the proposed Plan.

- Conduct all management in a manner that minimizes take to the maximum extent practicable.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must comply with the following terms and conditions which implement the reasonable and prudent measures described above. In order to reduce the potential to impact the bald eagle, the following terms and conditions must be applied on a Forest-wide basis. These terms and conditions will be non-discretionary.

1. Ensure that all Forest Service employees and contractors are educated to recognize and avoid bald eagle nest territories.
2. Seek new information annually on the distribution and status of bald eagles in the action area and apply such information to management to minimize take.

Requirements for Monitoring and Reporting of Incidental Take of the bald eagles

Federal agencies have a continuing duty to monitor the impacts of incidental take resulting from their activities [50 CFR 402.14(i)(3)]. In doing so, the Federal agency must report the progress of the action and its impact on the species to the Service as specified below.

1. Supply the Service with an annual report, due by January 31 of each following year, that specifies:
 - a. The status of known bald eagle nests on the Forest.
 - b. Any documented incidents of take.
 - c. Incidents of known illegal activity in nesting territories.
2. Progress on any terms and conditions implemented.
3. Care must be taken in handling dead bald eagle specimens that are found to preserve biological material in the best possible condition. The finding of any dead specimen should be reported immediately to the Service's East Lansing Field Office. Please contact your local Michigan Department of Natural Resources Conservation Officer to determine the proper disposition of the specimen. In addition, we request that you properly report the band number.

We anticipate that the taking of up to 16% of bald eagle nests due to recreational impacts on the Forest is reasonably certain to occur as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We believe that the HMNF has already initiated or participated in important efforts to protect, manage, and increase our understanding of the bald eagle, including their commitment to implement the Conservation Measures in the proposed action. We offer the following Conservation Recommendations to further expand the knowledge of this species, and help better manage for the Indiana bat in Michigan.

- Coordinate with resource agencies to acquire and disseminate bald eagle nesting data. Provide staff to participate in annual nest survey flights when space is available.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

Kirtland's warbler

The Forest has determined that the action being considered in this biological opinion is not likely to adversely affect the Kirtland's warbler. The following section discusses the status of the Kirtland's warbler, both on a range-wide basis and within the action area, and our evaluation of the determination for this species.

Status of the species and critical habitat

This section presents the biological or ecological information relevant to formulating the Opinion. The purpose is to provide the appropriate information on the species life history, its habitat and its range-wide distribution and conservation status for analyses in later sections. This section also documents the effects of all past human and natural activities or events that have led to the current status of the species.

Species Description

The Kirtland's warbler is a tiny bluish-gray songbird with a yellow breast and black streaks on its back. The male's plumage is brighter than the female's, and the male also has a black mask. Both sexes have a distinct whitish eye-ring split in front and behind. The Kirtland's warbler is yellow below with white undertail coverts, the sides and flanks are spotted. In autumn, the warbler's gray plumage becomes mixed with brown. The bird has a habit of constantly bobbing its tail up and down. Except for singing males, most activities of the Kirtland's warbler are concentrated low in the pines or on the ground.

Life History

Kirtland's warblers typically occupy jack pine stands greater than 80 acres in size, with several scattered small openings and a stocking density of 1089 or more trees per acre. Stands of 1,000 acres and larger have been found to improve nesting density and duration of stand use (Huber et al. 2001). Initial use may start when tree height reaches 5 to 7 feet or at an age of 6 to 10 years old, varying according to site conditions. Optimal breeding habitat structure begins to decline by the time the trees attain a height of 12 to 20 feet, or at an age of 16 to 21 years old, depending on the site. Kirtland's warbler populations begin to decrease when tree heights reach about 13.4 feet and the lower height of live foliage reaches about 3.2 feet (Probst and Weinrich 1993). Some evidence suggests that tree height and percent cover (i.e., stocking density) are the primary factors controlling habitat suitability for Kirtland's warbler and that nest site habitat is not a limiting factor (Probst and Weinrich 1993). Warblers typically occupy a new nesting area in small numbers at first, gradually increasing for a few years until a peak or plateau is reached, and then decline for a few more years until the area becomes unsuitable and no warblers remain.

Kirtland's warbler nesting habitat is dynamic and ephemeral. Warbler nesting locations move across the landscape through time as new jack pine stands become suitable and other stands age and become unsuitable. Kirtland's warblers are adapted to finding and using new breeding habitat. Their survival depends on continuous, uninterrupted regeneration of new breeding habitat throughout the northern Michigan jack pine forests.

The required habitat type is uncommon in Michigan and is restricted to poor, sandy soils of glacial origin. Areas of suitable nesting habitat are scattered and separated by areas of unsuitable habitat. Males occupy breeding territories which they appear to delineate by loud, persistent singing. Nests are constructed on the ground and by late May or early June clutches of 4 to 5 eggs are complete. Incubation requires about 14 days, and nestlings fledge in about 9 days (Walkinshaw 1983). Some Kirtland's warbler pairs nest a second time.

Kirtland's warblers migrate from their winter habitat in the Bahamas to their breeding habitat in Michigan in early to mid May with an average arrival date of May 12. Kirtland's warblers begin leaving the breeding areas for the migration south in mid-August. They depart over a lengthy period, with the last birds leaving Michigan as late as early October (Sykes et al. 1989). Their migration path, based on sightings (Mayfield 1960), seems direct between Michigan and the Bahamas. Recent information indicates that the Kirtland's warbler does not face significant threats on the wintering grounds (M. DeCapita, USFWS, pers. comm. 2005). Research is currently ongoing in the Bahamas to identify preferred winter habitat, quantify habitat use and diet, identify factors affecting distribution, and quantify site fidelity and winter site persistence.

Threats

The ultimate limiting factor on the nesting Kirtland's warbler population is the special habitat it requires. There is persuasive evidence that the amount of such habitat was at maximum during the brief lumbering period when forest fires were rampant in the pinelands during the 1880's and 1890's. The Kirtland's warbler also appears to have been at a peak at that same time. This contention is supported by the large number of specimens taken on the wintering ground during

that period. In modern times, forest fire control has reduced the total acreage burned and also the size of individual burns. These factors have worked to the disadvantage of the Kirtland's warbler. Also, practices that encourage the conversion of jack pine to other species have been detrimental. Currently, only 4,000 to 5,000 acres are suitable for breeding birds. This is a very substantial reduction from the 10,000 to 15,000 acres available in the 1950's and 1960's and is probably the most important reason for the decline in populations of the Kirtland's warbler.

A second threat to Kirtland's warbler is nest parasitism by the brown-headed cowbird (*Molothrus ater*). This prairie bird reached the Kirtland's warbler nesting range in the late 1800's with the clearing of the forests and development of agriculture in northern Michigan. This relatively new threat is particularly ominous because the Kirtland's warbler has none of the defenses against cowbird parasitism which are exhibited by many other songbirds. Thus, the cowbird has found the Kirtland's warbler a particularly vulnerable host. Walkinshaw (1972) found that 69 percent of the Kirtland's warbler nests he examined during 1966-1971 were parasitized. Other host species nesting in the same vicinity at that time had a far lower parasitism rate. Cowbird parasitism has, at times, reduced Kirtland's warbler production by at least 40 percent and in some years has almost completely wiped out the warbler's reproductive effort.

Recovery and Habitat Management

The Kirtland's warbler was first considered federally endangered on March 11, 1967 and was listed as such when the ESA was enacted in 1973. The Kirtland's warbler Recovery Plan was first finalized in 1976, and updates in 1985 (USFWS 1985). The recovery plan lists the following recovery objectives:

- A. Reestablish a self-sustaining Kirtland's warbler population throughout its known range at a minimum level of 1,000 pairs.
 1. Manage 127,600 acres (updated to 150,000) for the Kirtland's warbler. Encourage management on private lands.
 2. Protect the Kirtland's warbler on its wintering grounds and along the migration route.
 3. Reduce key factors adversely affecting reproduction and survival of Kirtland's warbler.
 4. Monitor breeding populations of the Kirtland's warbler to evaluate responses to management practices and environmental changes.
 5. Develop and implement emergency measures to prevent extinction.

The recovery plan also addresses protecting existing nesting habitat from destruction and degradation. It calls for "vigorous suppression" of wildfires that threaten breeding habitat, and controlling insects and diseases if it can be accomplished without directly or indirectly adversely affecting the breeding population. The recovery plan also calls for improving habitat by creating small openings where necessary, and removing or eradicating oak and other hardwoods within occupied breeding habitat. In addition, the recovery plan also emphasizes acquiring key parcels of land to meet habitat management objectives, providing information and education services to the public, meeting research needs, and evaluating and monitoring habitat management objectives.

The USFWS operates brown-headed cowbird control program on the Forest and elsewhere within the species range. Cowbird traps are placed in or adjacent to occupied stands of jack pine, at locations are determined by the previous year's annual Kirtland's warbler singing male census. Approximately 22 traps are operated on the Forest each year. The traps are 16 feet long, 8 feet wide, and 6 feet high and are constructed out of poultry netting and a wood frame using a modified crow trap design. A portion of the ceiling is constructed with a larger mesh wire to facilitate the entry of birds into the trap. Live cowbird decoys, fresh water and white millet seed are used to bait the traps. The traps are checked daily from mid-April to the end of June. All non-target birds are released and newly caught cowbirds are euthanized. To avoid impacts to Kirtland's warblers the traps are located along a road or trail, and are placed in the clearings created during the jack pine planting.

The Strategy for Kirtland's Warbler Habitat Management (Kirtland's warbler Strategy; Huber et al. 2001) directs how to manage for Kirtland's warbler breeding habitat. Management focuses on harvest and subsequent reforestation. Specifically, clearcutting is used as the most practical technique to remove standing jack pine. Dead trees, however, are usually retained. Sites are typically reforested by planting young jack pine. The site may require some preparation to improve reforestation, such as prescribed burning, roller chopping, chaining, or disking.

Target configuration for Kirtland's warbler suitable breeding habitat includes an average stocking density of 1,089 trees per acre with small non-forest inclusions (approximately 25% open per acre). Ideal tree spacing is approximately 6' X 6' or less (the Forest plants at 5' X 5'), with one to five well dispersed openings per acre. Due to the openings, the actual tree density (outside the opening) is about 1450 trees/ac.

The recovery plan outlines Kirtland's warbler habitat management assumptions, as follows:

Age of Occupied Habitat	8-22 Years
Duration of Use	15 Years
Acres of Habitat Required Annually for 1000 Pairs	38,000
Total Acres Required for Management	127,500

In 2001, The Kirtland's Warbler Recovery Team reviewed the recovery plan, particularly the assumptions used at the time to determine the amount of essential habitat needed to meet the recovery goal of 1000 pairs. This data was based on the best information available at that time. The goal stated in the recovery plan was to develop and maintain 38,000 acres of breeding habitat at all times by managing approximately 127,500 acres on Federal and State lands on a 45- to 50-year rotation: 53,488 acres (42%) on Federal lands and 74,143 (58%) acres on State lands. This would require regenerating 2,550 acres of jack pine annually. It also assumed approximately 1 breeding pair per 30 acres during a jack pine stand's optimum stage, and 15 years total occupancy.

More recent data suggests that some of these numbers may need to be updated. The average territory size is estimated to be 38 acres, not 30 acres. This estimate is based on the annual singing male census from 1980 to 1995. The average length of time (duration) a stand is used by

Kirtland's warblers is estimated to be less than 10 years, not 15 years. This estimate is based on duration analysis of stands on the Forest.

The number of acres of occupiable habitat required annually to establish and sustain a Kirtland's warbler population at a minimum level of 1,000 pairs is the same as it was in the recovery plan (38 acres/pair x 1,000 pairs = 38,000 acres). However, the total acreage required to be managed as essential habitat would be higher, if jack pine is managed on a 50-year rotation:

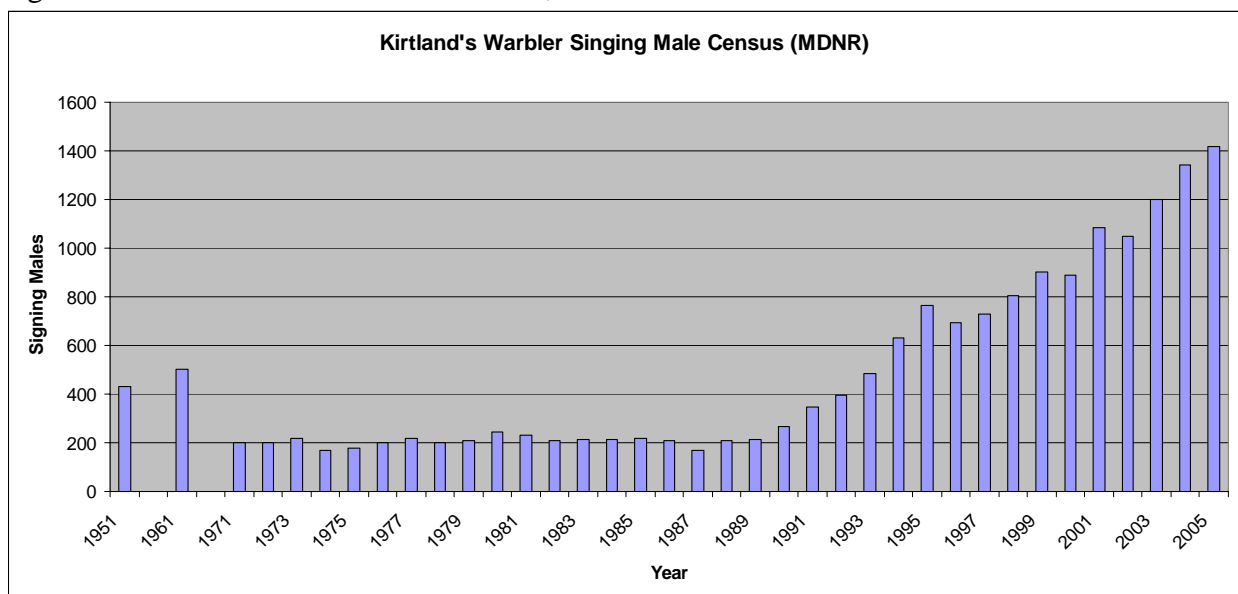
$$\begin{aligned} \text{Total acres of essential habitat required for management} &= \\ 38,000 \text{ acres} \times (50\text{-year rotation}/10\text{-year duration}) &= 190,000 \text{ acres} \end{aligned}$$

At present, approximately 151,000 acres of essential habitat has been identified in the Lower Peninsula of Michigan for Kirtland's warbler breeding habitat management. Based on the information presented above, this represents a shortfall of approximately 39,000 acres of essential habitat required to sustain the breeding population of Kirtland's warblers at 1,000 pairs. It is likely that a large portion of these remaining acres will be developed in Michigan's Upper Peninsula, particularly on lands owned by the Hiawatha National Forest.

Status and Distribution

The Kirtland's warbler population was first censused in 1951 by counting singing males (432 males). Total breeding adult population is assumed to be double the number of singing males counted. The next count in 1961 was 502 males, but the third count in 1971 declined 60% to 201 males. Between 1972 and 1989, the population remained somewhat stable, ranging from 167 to 214 males. Since 1989, the population has increased annually, exceeding 1000 pairs every year since 2001 (Figure 5). The recent population increase is a result of habitat and cowbird population management by the MDNR, USFWS and Forest Service, as well as the creation of a large block of natural habitat by the 1980 Mack Lake Fire in northern lower Michigan.

Figure 5. Kirtland's warbler census results, 1951 - 2005.



Since 1996 the number of Kirtland's warblers in the Upper Peninsula has ranged from 6 to 19 singing males. Kirtland's warbler numbers in the U.P. were high in the late 1990's due to several wildfires that occurred in the 1980's (Indian Lake Fire, 8-Mile fire, wildfires near Gwinn, MI).

At present, Kirtland's warbler nesting habitat is found almost entirely on State and Federal public forest land. As of 2004, the entire known breeding range of the Kirtland's warbler was found in 12 counties in Northern Lower Michigan and 6 Upper Michigan counties. The Forest Service and the Michigan Department of Natural Resources began habitat management in the 1960s and together have dedicated 24 management areas on about 150,000 acres for the Kirtland's warbler in the Lower Peninsula. Typically, habitat management in the Lower Peninsula consists of clearcutting 300 acres or larger stands of jack pine on a 50-year rotation followed by mechanical or hand planting of two year old jack pine seedlings. In the Lower Peninsula, approximately 2,760 acres must be managed annually to provide about 38,000 acres of nesting habitat in any year. Habitat management has been extremely successful. The Kirtland's warbler population in Michigan has increased in response to the increase in availability of nesting habitat and cowbird control. Research has shown that Kirtland's warblers in the Upper Peninsula successfully breed and interact with populations in the Lower Peninsula (Probst et al. 2003).

Summary and Synthesis of the Species Status

The Kirtland's warbler is a small song bird that winters in the Bahamas and breeds in Michigan. Suitable Kirtland's warbler breeding habitat is found in large stands of young jack pine growing on sandy soils with high tree densities and interspersed openings. The species was driven nearly to extinction by fire suppression and nest parasitism by cowbirds. Habitat management consists of clearcutting large stands of jack pine on a 50-year rotation, followed by mechanical or hand planting of jack pine seedlings. Kirtland's warblers have responded well to the active management program, with the total breeding population exceeding 1000 pairs every year since 2001. However, full recovery of the species will require continuous active management into the foreseeable future.

Environmental Baseline

This section describes the species status and trend information within the action area. It also includes State, tribal, local, private actions already affecting the species or that will occur contemporaneously with the proposed action. Unrelated Federal actions that have completed formal or informal consultation are also included in the environmental baseline.

Status and Distribution of the Species in the Action Area

The number of Kirtland's warblers on the Forest has changed dramatically over the past 30 years (Figure 5). In 1971, only 67 singing males were censused, and in 1975, dipped to a record low of 19 singing males. From 1976 to 1985, the number of birds remained steady, averaging of 43 birds per year over the 10-year period. From 1986 to 1995, the Forest and the entire population saw a substantial increase as a result of habitat created by the 1980 Mack Lake Fire. From 1995

to 2004, the number of birds remained steady at a higher plateau, averaging 384 birds per year over the 10-year period.

Factors Affecting the Species Within the Action Area

On the Forest, various land management practices potentially affect the Kirtland's warbler. These practices primarily include recreation, roads and trails, and other human activities. The factors affecting Kirtland's warbler, as discussed in the Forest's BA, are detailed below in the primary categories of influence.

1. Breeding habitat

The Forest currently manages approximately 70,000 acres of essential habitat in seven KWMA's, all on the Huron National Forest. Habitat management and other activities within these KWMA's are guided by the Forest Plan and the Strategy. An examination of Kirtland's warbler biogeography (Probst et al. 1995) suggests that the birds prefer to nest in large stands (1,000+ acres) of young jack pine. Kirtland's warblers nest in higher densities in larger stands, and these large stands are used for a longer period of time than smaller stands. The guidelines in the Forest Plan are primarily those that are only relevant to the Forest. For instance, the 1986 Forest Plan allows treatment block to be no more than 550 acres, unless reviewed by the Regional Forester. It also permits one treatment block to be placed adjacent to another as long as one block is stocked with trees. Another Forest Plan guideline sets the minimum number of snags at 15 to 25 per acre in treatment blocks.

To continuously provide breeding habitat for Kirtland's warblers, the Forest harvests and regenerates an average of 1,070 acres of essential habitat annually. The Forest maintains a schedule of habitat treatments by year and KWMA, and attempts to distribute the treatments across and within KWMA's. In keeping with Strategy direction, treatment blocks are scheduled for regeneration close to other blocks in space and time.

From 1986 to 2004, an average of 1,119 acres of breeding habitat was provided on the Huron National Forest, as a result of active management and wildfire.

In 2004, approximately 8,157 acres of habitat were occupied by the Kirtland's warblers on the Huron National Forest. Ninety-five percent of the acres of occupied habitat resulted from the establishment of jack pine plantations. Only one singing male was found in a wildfire area. Several stands on the Huron Forest were fully stocked with natural regeneration. Jack pine trees in these stands occur at densities suitable for Kirtland's warbler nesting habitat. A few stands continue to be impacted by sphaeropsis, particularly in the Pine River KWMA. However, due to the size difference of the planting stock and trees in occupiable habitat, nothing can be done to improve the low stocking density of these stands.

2. Human activity and disturbance

This factor addresses the human activities and disturbances that may affect reproduction and survival of Kirtland's warblers. An objective of the KWRP is to reduce human factors that

adversely affect reproduction and survival of Kirtland's warblers. Potentially-disturbing activities include unauthorized entry into occupied breeding habitat, the annual census, guided tours, research, special uses (photography, recording, etc.), recreational trails, and special events (off-road vehicle events, equestrian trail rides, military training exercises, etc). However, most of these activities are expected to have only minimal negative impacts on Kirtland's warblers.

The 1986 Forest Plan provides direction for controlling human activities and the 2001 Kirtland's warbler Strategy clarified guidelines related to this issue. These guidelines provide direction on habitat closures and posting, roads, recreational trails, mineral development, fire prevention and control, insect and disease control, timber harvest, reforestation and other activities. These measures appear to provide ample control of human activities that may be detrimental to the Kirtland's warbler.

The Forest Plan states that public information and education programs will be implemented to explain resource management direction and activities in coordination with other public and private organizations. The Forest has actively promoted public awareness through guided Kirtland's Warbler tours, the annual Kirtland's Warbler Festival, the Jack Pine Wildlife Viewing Tour, informational signing, public meetings and presentations, web pages, brochures and other media. On a very limited basis, the Forest permits or contracts the photographing, video-taping and recording of the Kirtland's warbler to provide media for promoting public awareness.

3. Nest parasitism by the brown-headed cowbird

The USFWS has successfully trapped cowbird on the Forest since 1972. The Forest Service permits access to the lands it administers for cowbird control activities. The Forest Plan states that "control of predators and parasites, such as cowbirds, will be completed within the scope of the Recovery Plan and coordinated through the USDI Fish and Wildlife Service and the Kirtland's Warbler Recovery Team. Fish and Wildlife Service will conduct these cowbird control programs." The Forest issues annual permits to FWS employees to conduct cowbird control efforts. The Kirtland's warbler population increase of recent years on the Forest indicates that reproduction and survival is healthy and that cowbird parasitism is under control.

Summary and Synthesis of the Environmental Baseline

The number of Kirtland's warblers on the Forest has increased dramatically over the past 30 years. In 1971, only 67 singing males were censused, and in 1975, dipped to a record low of 19 singing males. From 1995 to 2004, the number of birds remained steady, averaging 384 birds per year over the 10-year period. The HMNF currently manages approximately 70,000 acres of essential Kirtland's warbler habitat. To continuously provide breeding habitat for Kirtland's warblers, the Forest harvests and regenerates an average of 1,070 acres of essential habitat annually. The Forest implements several guidelines to minimize human disturbance in Kirtland's warbler habitat. In addition, the Forest issues annual permits to FWS employees to conduct cowbird control efforts. The Kirtland's warbler population increase of recent years on the Forest indicates that reproduction and survival is healthy and that cowbird parasitism is under control.

Effects of the Action

This section assesses the effects of the proposed action, including the direct and indirect effects together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). This section also assesses the cumulative effects, including the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area. We are not aware of any actions that are interdependent or interrelated to the proposed action being considered in this Opinion.

Analysis for the Effects of the Action

Effects of the Forest Plan Goals, Objectives, and Desired Conditions on the Kirtland's warbler

The Forest Plan would move the Forests toward the desired conditions, goals and objectives for Kirtland's warbler management and provide direction for producing quality breeding and nesting habitat, sufficient acres of essential habitat, and protective measures for the Kirtland's warbler. The Forest Plan would provide sufficient acreage of essential habitat to sustain Kirtland's warbler breeding and nesting habitat management over the short and long term. A minimum of 79,800 acres of essential habitat is needed to provide breeding and nesting habitat for 420 pairs. The Forest Plan would provide approximately 88,300 acres of designated essential habitat. This would be enough to sustain 420 pairs over the short and long terms, with enough additional habitat to meet other management objectives.

The proposed Plan directs that recovery plans for listed species, including the Kirtland's warbler, be implemented. The proposed Plan also ensures that partnerships will continue by directing cooperation and coordination with responsible government and land and resource management agencies, tribes, and partners regarding endangered, threatened, and sensitive species. In addition, the proposed Plan formally adopts the Kirtland's warbler Strategy (Huber et al., 2001). This document provides critical protective measures for individual Kirtland's warblers and the larger area of essential habitat on the Forest. Measures addressed in the Kirtland's warbler strategy include seasonal activity restrictions to protect breeding birds, restrictions on roads and trails, and direction for habitat-affecting activities (e.g., fire prevention and control, minerals development, timber salvage) to be performed in a manner that improves habitat.

We believe that the overall goals, objectives, and desired conditions of the proposed Plan are consistent with the ecological needs of the Kirtland's warbler. We expect that implementation of this plan will protect and manage for viability of the Kirtland's warbler.

Effects of the specific management actions on the Kirtland's warbler

Although the overall goals of the proposed action are expected to benefit the Kirtland's warbler, the means by which the Forest will achieve their goals may unavoidably cause adverse effects to this species. This analysis assesses the likelihood and magnitude of impacts that may result

directly or indirectly from specific proposed management actions or from the long-term operation of management activities. Specifically, we assess the measurable and detectable responses of Kirtland's warblers exposed to the proposed management actions and the environmental impacts associated with the actions, and the likelihoods of the exposure and the consequent response occurring.

The program-level analysis lacks definitive temporal and spatial information for the specific management actions. Although the standard and guidelines assist with narrowing our scope of analysis by specifying timing and habitat restrictions, our analyses are necessarily broad. Thus, we identify both the range of possible responses and the most likely responses anticipated for each management activity. Many of the standards and guidelines significantly reduce the potential impacts for Kirtland's warblers, effectively neutralizing most potential negative responses. However, some potential for negative responses remain.

Appendix F deconstructs the actions in the proposed Plan. The table focuses on those proposed Plan actions and effects of most concern to listed species. The table identifies the proposed management actions and associated project elements, the environmental impacts resulting from these project elements, and the likely responses of individuals exposed to these environmental impacts. It also describes the anticipated effects to the affected population in terms of reproduction, numbers, and distribution. These tables were intended to be read in concert with the following effects analysis section.

We focus on the impacts to individual fitness responses (in particular, effects on individual breeding and survival rates). Once we anticipate the individual fitness responses, we then look at how these individual responses affect the fitness of the population in which these individuals belong. Lastly, we assess how the anticipate changes, if any, at the population level will affect the fitness of the species rangewide.

The standards and guidelines that reduce exposure and responses are described in more detail in the Proposed Action section. It is important to emphasize that this effects analysis is predicated on the fact that all standards and guidelines will be fully implemented, as intended. If not, this analysis may no longer be valid.

- Range Management

The four active grazing allotments on the Forest are not within Kirtland's warbler habitat. We do not expect Kirtland's warbler to be exposed to any range management activities.

- Watershed Management

Watershed management activities are prohibited in Kirtland's warbler habitat. We do not expect Kirtland's warbler to be exposed to any watershed management activities.

- Forest Pest Management

The Forest cooperates with the USFWS in the control of cowbirds. Approximately 22 traps are operated on the Forest each year. To avoid direct impacts to Kirtland's warblers, the traps are located along a road or trail, and are placed in the clearings created during the jack pine planting. We expect forest pest management to provide essential relief from otherwise heavy cowbird nest parasitism. Without cowbird control, Kirtland's warbler nesting success would likely be too low to sustain the population, even with active habitat management.

The Forest may employ chemical pesticides to control other insect pests in Kirtland's warbler habitat. However, we do not expect pesticide use to cause any adverse impacts to Kirtland's warblers because the Forest Plan includes a standard to coordinate with species experts on the Kirtland's warbler Recovery Team and with the USFWS before such actions are implemented. We anticipate that, through this coordination, pesticide use will be planned so that they elicit no detectable response from Kirtland's warblers.

- Wildlife, Fish, and Sensitive Plant Management

As detailed in Appendix F, management of wildlife, fish, and sensitive plants may have several environmental impacts on the Kirtland's warbler. However, note that many actions that will improve habitat or otherwise benefit species on the Forest are expressed as standards and guidelines for other management activities, and will not be discussed here. Impacts of wildlife openings management will be discussed with barrens creation, under timber management below. Kirtland's warblers should not be exposed to management of wetlands since they do not reside in or near wetland habitats.

The proposed Plan contains provisions to implement recovery plans for listed species, including the recovery plan for the Kirtland's warbler. The Forest is an essential player in the recovery of Kirtland's warbler, providing a significant portion of the occupied and suitable habitat. The proposed Plan would provide sufficient acreage of essential habitat to sustain Kirtland's warbler breeding and nesting habitat management over the short and long term. The Forest has a goal of 420 pairs maintained on at least 79,800 acres of essential habitat. The Plan exceeds this number and proposes approximately 88,300 acres of designated essential habitat. This would be enough to sustain 420 pairs over the short and long terms, with enough additional habitat to meet other management objectives.

The Forest proposes to create approximately 1,600 acres of breeding habitat per year based on the assumptions that 1) habitat is occupiable for 10 years, and 2) each pair occupies an average of 38 acres over the life of an average stand. Over time, approximately 16,000 acres of habitat would be available to an average of 420 nesting pairs of Kirtland's warblers annually. Additionally, if the average number of acres required per pair decreases due to an increase in the size of treatment blocks, then the average number of nesting pairs could increase above the minimum.

The Forest is also working to achieve other Kirtland's warbler recovery goals. They work closely with Bahamian groups involved in Kirtland's warbler management to protect wintering

habitat. They cooperate with the USFWS to minimize the threat from cowbird nest parasitism (as discussed in the Status of the Species Section). They, along with the USFWS, work to educate the public about Kirtland's warblers by operating tours of occupied habitat. Tours are operated under strict guidelines. Participants are required to minimize noise and stay on roads or trails. We do not expect any measurable negative impacts from the tours.

The Forest also organizes an extensive annual census that documents and monitors breeding birds on the Forest. The Forest cooperates with other agencies, including the USFWS and Michigan DNR, and numerous volunteers with the goal of censusing all singing males to approximate the number of nesting pairs each year. Care is taken when operating in occupied habitat. Participants are directed to minimize the movement within the habitat to a single transect line. Birds are located and counted by listening to calls. No visual confirmations of birds or nests are required. However, it is possible for nests to be crushed by participants, causing death or injury of eggs and chicks.

We expect that implementation of these actions will contribute positively to the overall conservation status of the Kirtland's warbler. Specifically, implementing these actions will facilitate the timely recovery of this species on the Forest and throughout its range.

- Minerals and Geology

As detailed in Appendix F, there are a variety of environmental consequences from minerals and geology activities. These activities may affect Kirtland's warbler habitat by changing or eliminating native vegetation. Furthermore, some operations (i.e., gravel mining) will cause noise and other human disturbances. Any oil/gas development activity in Kirtland's warbler essential habitat would have strict operating requirements that minimize potential impacts. Operating requirements include prioritization of currently unsuitable habitat for development, limits for noise within one-half mile of occupied habitat during the breeding season, buried pipelines, and a reclamation plan to restore the character of the site. Enforcement of these operating requirements will significantly reduce potential negative impacts on Kirtland's warbler habitat.

However, it is likely that some new or expanded development of mineral and geology resources (e.g., oil or gas wells) will be allowed on a case-by-case basis in essential habitat. These activities may remove small sections of unoccupied essential habitat, which may reduce the future number of birds breeding in the affected stand. The Forest anticipates that 35 acres may be developed in Kirtland's warbler essential habitat, removing small sections of unoccupied breeding habitat (P. Huber, USFS, pers. comm. 2005). However, the proposed Plan designates 88,300 acres of essential habitat which is 8,500 acres more than the 79,800 acres determined to be necessary to sustain the Forest's 420 pairs (the level required for a viable population on the Forest). With this additional acreage, any future nesting pairs displaced by small losses of essential habitat should be able to nest elsewhere without any measurable impacts to their reproductive potential. In fact, this additional essential habitat was designated by the Forest specifically to compensate for some anticipated reductions from minerals and geology development and other objectives. Thus, as long as the Forest does not develop more than 35

acres of minerals and geology development in essential habitat, we do not anticipate any detectable impact on individual birds or the population as a whole.

- Transportation System

Limited transportation management activities are expected in Kirtland's warbler essential habitat. Direct exposure to Kirtland's warblers, however, is unlikely because the Forest will require that activities within or adjacent to occupied habitat be performed outside of the breeding season.

The Forest directs construction of new roads to avoid Kirtland's warbler essential habitat. However, it is possible that some new construction may be allowed on a case-by-case basis. In addition, upgrading or widening of existing roads may impact small areas of essential habitat. These activities may remove small sections of unoccupied breeding habitat. This could cause a small reduction in the number of birds breeding in the affected stand. However, the proposed Plan designates 88,300 acres of essential habitat which is 8,500 acres more than the 79,800 acres determined to be necessary to sustain the Forest's 420 pairs (the level required for a viable population on the Forest). With this additional acreage, any nesting pairs displaced by small losses of essential habitat should be able to nest elsewhere without any measurable impacts to their reproductive potential. In fact, this additional essential habitat was designated by the Forest specifically to compensate for some anticipated reductions from transportation or other objectives. Thus we do not anticipate that the limited losses expected from transportation projects will have a detectable impact on individual birds or the population as a whole.

The Forest will also operate their existing road system in Kirtland's warbler habitat. Road-related activities facilitate human access into occupied Kirtland's warbler habitat. While entry into occupied habitat is technically illegal by Forest Service area closure, individuals may enter illegally on their own, legally while on an official Kirtland's warbler habitat tour, or with special Forest Service permissions (i.e., photography, research). While a low level of human disturbance likely goes unnoticed by most birds, roads with a higher level of use may disturb nesting birds. This may diminish the suitability of the habitat in proximity to roads or some birds may be forced to abandon nests established in such areas. In addition, where foot or vehicle traffic moves off-road, eggs and chicks may be crushed. It follows that where roads are closed or decommissioned, Kirtland's warbler habitat in those areas should improve and increase local breeding success.

Road maintenance activities should have few impacts to Kirtland's warbler habitat because they are concentrated within the right-of-way. The Forest directs most road maintenance near occupied habitat to occur outside of the breeding season, making exposure to birds unlikely.

- Recreation Management

We do not expect that Kirtland's warblers are currently or will be exposed to developed recreational facilities. Currently, there are no such facilities in essential habitat. In addition, new facilities in essential habitat are extremely unlikely to be built.

The Forest will not construct new trails in essential habitat. While the Forest will relocate existing trails out of essential habitat where possible, much of the existing recreational trail system will remain. Actual physical loss of habitat from trails is very small and should not have detectable impacts on Kirtland's warblers. While entry into occupied habitat is technically illegal by Forest Service area closure, individuals may enter illegally on their own, legally while on an official Kirtland's warbler habitat tour, or with special Forest Service permissions (i.e., photography, research, census activities). While a low level of human disturbance likely goes unnoticed by most birds, trails with a higher level of use may disturb nesting birds. This may diminish the suitability of the habitat in proximity to roads or some birds may be forced to abandon nests established in such areas. In addition, where foot or vehicle traffic moves off-trail, eggs and chicks may be crushed. It follows that where roads are closed or decommissioned, Kirtland's warbler habitat in those areas should improve and increase local breeding success.

- Fire Management

As described in the Status of the Species section, fire is a dominant force shaping the jack pine barrens ecosystem that provide Kirtland's warbler habitat. Without frequent fire, the density and configuration of jack pine required for Kirtland's warbler breeding do not develop. The Forest has an active wildfire suppression program that essentially prohibits this natural fire disturbance regime and reduces the frequency and intensity of wildfires on the Forest. Fire suppression resulted in the historic decrease in the amount and condition of Kirtland's warbler habitat and decline of the population on the Forest. The proposed Plan continues with a policy of wildfire suppression and thus suppression of the natural development of Kirtland's warbler breeding habitat.

Fire suppression activities in response to wildfires, such as line control and aerial detection and control, may cause noise and physical disturbance, exposure of mineral soil, and erosion. However, active fire suppression occurs sporadically in response to wildfire activity. We do not expect these impacts to occur on a scale and frequency that would impart measurable impacts on Kirtland's warblers. In addition, although wildfire during the breeding season is uncommon (P. Huber, USFS, pers. comm. 2006), protection of occupied Kirtland's warbler habitat from approaching wildfires will reduce potential death or injury of birds. Aggressive protection is critical since the loss of even one stand of birds could significantly diminish the long-term reproductive potential of the population.

Prescribed burning may be used in association with breeding habitat management to facilitate site reforestation and the reestablishment of jack pine after a clearcut. This allows the clearcutting program to better mimic the natural effects of wildfire on the habitat. Where used, we expect prescribed burning to improve the quality of the breeding habitat developed and increase Kirtland's warbler breeding success in those areas. The Forest will not burn in occupied habitat. Any burning done near occupied habitat will be planned to avoid smoke drift into breeding birds (P. Huber, USFS, pers. comm. 2006). Therefore, we do not expect birds to be directly exposed to prescribed burning.

Another component of fire management is proactive reduction of hazardous fuels loads to minimize wildfire risk. The Forest will manage hazardous fuels loads in essential habitat using prescribed burning and timber harvest. We do not expect birds to be directly exposed to prescribed burning because: 1) the Forest will not burn in occupied habitat and 2) any burning done near occupied habitat will be planned to avoid smoke drift into breeding birds (P. Huber, USFS, pers. comm. 2006). In addition, the Forest would not remove large areas of forested cover (stand size or greater) in essential habitat in a manner that would preclude the development of suitable breeding habitat. However, the proposed Plan provides for 8,090 acres of pre-suppression fuelbreaks in the first decade. The Forest anticipates that 4,000 acres of these fuel breaks would be created in Kirtland's warbler essential habitat, removing small sections of unoccupied breeding habitat (P. Huber, HMNF, pers. comm. 2005). This could cause a small reduction in the number of birds breeding in the affected stand. However, the proposed Plan designates 88,300 acres of essential habitat which is 8,500 acres more than the 79,800 acres determined to be necessary to sustain the Forest's 420 pairs (the level required for a viable population on the Forest). With this additional acreage, any nesting pairs displaced by small losses of essential habitat should be able to nest elsewhere with out any measurable adverse impacts to their reproductive potential. In fact, this additional essential habitat was designated by the Forest specifically to compensate for some anticipated reductions from fuel breaks and other objectives. Thus, as long as the Forest does not develop more than 4,000 acres of fuel breaks in essential habitat, we do not anticipate any detectable impact on individual birds or the population as a whole.

- Timber Management

To maintain the Kirtland's warbler in the face of wildfire suppression, the Forest actively manages the jack pine in designated essential habitat. Timber harvest methods, thoroughly described in the Status of the Species section, involves jack pine clearcuts on an approximately 50-year rotation, but may involve cutting older or younger stands of trees. Reforestation typically includes machine planting, hand planting, or reseedling of jack pine. (Prescribed burning may also be used in reforestation efforts. See previous discussion under fire management)

Overall, the timber management program has immense benefits for the Kirtland's warbler. All timber management efforts take place in unoccupied habitat so there is no direct exposure to individual Kirtland's warblers. Indirectly, however, these activities sustain the Kirtland's warbler on the Forest. The program creates a constant rotation of suitable breeding habitat, allowing for continuous and consistent Kirtland's warbler breeding on an annual basis. Under this proposed Plan, the Forest proposes to provide 15,960 acres of essential breeding habitat for the Kirtland's warbler per decade. Assuming that habitat is occupiable for 10 years, an average of 1,596 acres would be harvested and reforested annually to meet this goal. In addition, with the barrens creation program sometimes creates dense clumps of jack pine that may provide additional habitat for the Kirtland's warbler outside designated essential habitat areas.

The proposed Plan makes improvements that should increase the effectiveness of the Kirtland's warbler timber management program. The proposed Plan strives to maximize essential habitat block size by increasing the potential size of a treatment block size to 550 acres. Additionally,

treatment blocks may be placed adjacent to one another to create even larger stands. Harvesting of immature stands will also be permitted to further create large treatment blocks. These changes will benefit the Kirtland's warblers because they nest in higher densities in larger blocks, and larger blocks are used for a longer period of time than smaller blocks.

The proposed Plan also includes a guideline that allows some seed-tree or shelterwood cut method for regenerating jack pine. These techniques are generally unsuccessful in producing quality Kirtland's warbler breeding habitat and could render some areas of jack pine unsuitable or delay development of suitable habitat (Huber et al. 2001). However, we do not expect any negative response from Kirtland's warblers because the loss of this potential habitat will be greatly outweighed by the larger habitat management program on the Forest.

The Forest Plan permits firewood gathering in Kirtland's warbler unoccupied essential habitat. This could degrade specific areas of existing and future nesting habitat by reducing structural diversity over the short and long terms. However, we do not expect the small amount of firewood gathering that may occur to have any detectable impact on Kirtland's warblers.

Cumulative Effects

Cumulative effects include the combined effects of any future State, local, or private actions that are reasonably certain to occur within the action area covered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Although we are aware of no major non-Federal actions that are reasonably certain to occur in the action area, it may be assumed that some activities, particularly on private lands, could have a progressive negative effect on the Kirtland's warbler in the action area. Human populations in the counties with Kirtland's warbler habitat have been rapidly increasing in recent years (USFS 2003a). Human population growth is typically accompanied by increased urbanization, including road construction and land development. Both of these activities may result in the permanent loss of potential Kirtland's warbler habitat. Additional actions performed on private lands that may adversely affect the Kirtland's warbler in the future are fire suppression, OHV use, and timber harvest. Additionally, the development of privately-owned mineral rights is possible on both private and Forest Service lands. Mineral rights on Federal lands are subject to an environmental analysis, review, oversight, and permit from the Federal agency. The Federal agency, however, may not be able to condition a permit in a manner that would preclude the development of the resource. In such cases, the Forest may not be able to impose a "no surface occupancy" stipulation in the permit for mineral extraction in Kirtland's warbler habitat, and the species may be adversely affected.

Conclusion

After reviewing the current status of the Kirtland's warbler, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the

Kirtland's warbler. No critical habitat has been designated for this species; therefore, none will be affected.

There are likely to be adverse effects to the Kirtland's warbler in the action area as a result of recreation, transportation, and fire management. These adverse effects are expected to be in the form of habitat degradation (i.e., natural development of breeding habitat) and take, including reduced reproductive capacity and success, along with death or injury of eggs and chicks. The Forest has committed to avoiding or reducing these impacts by limiting and managing those activities in Kirtland's warbler essential habitats, as necessary. We believe that, while a level of adverse effects remains, the proposed action taken together with cumulative effects is not reasonably expected to, directly or indirectly, reduce appreciably the likelihood of both the survival and recovery of the Kirtland's warbler in the wild by reducing the species' reproduction, numbers, or distribution within the action area. To the contrary, the Forest will take considerable measures to manage for Kirtland's warbler breeding habitat, which will ultimately contribute significantly to its recovery.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

In general, an incidental take statement (ITS) specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize the impacts of the take and sets forth terms and conditions which must be complied with in order to implement the reasonable and prudent measures.

Relationship of Program-level ITS to future project-level ITS

Any future actions completed under the proposed Plan that may adversely affect the Kirtland's warbler will require section 7 formal consultation. These consultations will proceed using the procedures outlined in the "Programmatic Consultation Approach" section in the accompanying Opinion (beginning on page 4). A Level 2 biological opinion will be written and appended to this Opinion for each project that may adversely affect the Kirtland's warbler. During this Level 2 consultation, project-specific incidental take, as well the cumulative amount of take pursuant to implementation of the proposed Plan that has occurred, will be assessed. Section 9 exemption

under the terms of sections 7(b)(4) and 7(o)(2) of the Act will be granted, if appropriate. In these future ITSs, reasonable and prudent measures and terms and conditions to minimize the effect of any incidental take that may result will be developed and applied, as appropriate.

Amount or Extent of Take

In this ITS, we are evaluating the incidental take of Kirtland's warbler that may result from implementation of the proposed Plan. A Forest Plan is a permissive plan level document that allows and guides, but does not authorize, specific actions to occur. As explained within the accompanying Opinion, the proposed Plan allows for actions that are likely to adversely affect the Kirtland's warbler. As such, specific actions conducted under the proposed Plan may result in adverse effects to individual Kirtland's warblers that rise to the level of take. The standards and guidelines proposed as part of the proposed Plan, however, substantively reduce the potential for adverse effects and incidental take to occur. Therefore, projects completed under the proposed Plan that comply with the standards and guidelines in many cases will not adversely affect Kirtland's warblers such that take would not be anticipated. There may be situations, however, in which incidental take is likely regardless of whether the standards and guidelines are adhered to. Specifically, we anticipate that take could occur primarily with the operation of roads and trails in and near occupied habitat and with some fire and timber management actions.

This section addresses only a subset of the adverse effects analyzed in the Effects section. Specifically, we identify the effects that will: 1) rise to the level of take and are reasonably certain to occur, and 2) are within the action agency's discretion. Thus, adverse effects that not expected to rise to the level of take, are not reasonably certain to occur, or are not under the jurisdiction of the action agency, are not analyzed in this ITS. In addition, the Effects Analysis section identified take that could result from illegal access to occupied habitat during the breeding season, specifically crushing or disturbance of nests from foot traffic and OHV use off of trails and roads. Any take that occurs due to illegal human use is outside the jurisdiction and authority of the Forest Service and not exempted by this ITS and therefore not the responsibility of the Forest Service.

Incidental take resulting from the proposed Plan falls under two categories: 1) take that will result from specific future events and 2) take will not result from specific future events, but involves long-term programmatic management. This ITS addresses these two types of take separately.

Take from specific future events

As discussed in the biological opinion, we anticipate that some specific projects could adversely impact essential Kirtland's warbler habitat. Regarding transportation, projects involving new road construction and road widening and upgrading could result in the loss of essential habitat. However, these projects are expected to involve state or county roads. Projects on these roads should have a federal nexus other than the Forest Service and any incidental take that may result will be exempted under other section 7 consultations, as appropriate. Thus, we will not exempt any take from transportation projects here. Similarly, the Forest allows access for researchers to study Kirtland's warblers. These researchers are expected to have acquired the proper permitting

(e.g., section 10(a)(1)(A) permit) and any take that may result from those activities would be addressed under the accompanying section 7 consultations.

Some specific projects, however, will be the direct responsibility of the Forest. The Forest will permit a limited amount of minerals and geology development in essential habitat. Also, the Forest will create some fuel breaks in essential habitat. However, the proposed Plan designates 88,300 acres of essential habitat which is 8,500 acres more than the 79,800 acres determined to be necessary to sustain the Forest's 420 pairs (the level required for a viable population on the Forest). With this additional acreage, any nesting pairs displaced by small losses of essential habitat should be able to nest elsewhere with out any measurable impacts to their reproductive potential. In fact, this additional essential habitat was designated by the Forest specifically to compensate for some anticipated reductions from other objectives. Thus, as long as the amount of habitat loss from minerals and geology development and fuel breaks remains at or below anticipated levels and these and any other losses of essential habitat do not exceed 8,500 acres, we do not expect any detectable impacts on the reproductive potential of individual birds or the population as a whole.

Take from programmatic activities

Fire is the dominant force shaping the jack pine barrens ecosystem that provide Kirtland's warbler habitat. Without frequent fire, the density and configuration of jack pine required for Kirtland's warbler breeding do not develop. The Forest has a programmatic wildfire suppression policy that essentially prohibits this natural fire disturbance regime and reduces the frequency and intensity of wildfires on the Forest. Fire suppression greatly contributed to the historic decrease in the amount and condition of Kirtland's warbler habitat and decline of the population on the Forest. However, the Forest's active and successful program to manage jack pine for Kirtland's warbler essential habitat dramatically reduces potential losses of Kirtland's warbler breeding potential. As long as the Forest continues managing essential habitat, we do not expect any take of Kirtland's warbler resulting from wildfire suppression.

The annual population census, while a critical component of Kirtland's warbler management, may directly impact Kirtland's warblers by: 1) causing disturbance that leads to nest abandonment or 2) having a census participant inadvertently crush a nest. These activities could cause the death or injury of chicks or eggs. Any take resulting from census activities will be nearly impossible to detect because Kirtland's warbler nests are so well camouflaged in the abundant ground cover and downed wood. However, given the continually increasing numbers of birds on the Forest in the face of more than 30 years of annual census activity, any impact from the possible loss of nests on the population has been undetectable. Furthermore, as described in the biological opinion, the Forest and their cooperators operate the census under strict guidelines that greatly minimize the potential for adverse impacts and take to occur. Thus, in most years, we do not anticipate that the census will result in take of any nests. However, with individuals walking through numerous acres of occupied habitat every year, we believe that occasional take of a nest through disturbance or direct crushing is reasonably certain to occur. We anticipate that take will be infrequent, causing the loss of up to 1 nest every 4 years, or total of 5 nests (along with all associated chicks and eggs) over the life of the proposed Plan.

Monitoring incidental take of individual nests will be difficult because noticing that a nest as been crushed or finding a dead birds is unlikely due to small body size and camouflaged nest locations. However, as long as the Forest does not dramatically alter the census protocol, we expect that this level of take will not be exceeded.

Effect of Take

In the accompanying Opinion, we determined that the proposed action is not likely to jeopardize the continued existence of the species. Therefore, we have determined that the level of anticipated incidental take associated with the actions completed under the proposed Plan are not likely to jeopardize the Kirtland's warbler. Any take that occurs will be small in comparison to the total number of birds on the Forest at any given time. Furthermore, the benefits of the Forest's expansive habitat management program will greatly outweigh the effects of a small number of individuals taken.

Reasonable and Prudent Measures

The following Reasonable and Prudent Measures may be applied to minimize the effect of incidental take that may result from the annual Kirtland's warbler census.

- Conduct all management in a manner that minimizes take to the maximum extent practicable.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must comply with the following terms and conditions which implement the reasonable and prudent measures described above. The following terms and conditions should be applied to all census activities in order to reduce the potential to impact the Kirtland's warbler. These terms and conditions are non-discretionary.

1. Ensure that all Forest Service employees, cooperators, and volunteers understand how to avoid nests during the annual census.

Requirements for Monitoring and Reporting of Incidental Take of the Kirtland's warbler

Federal agencies have a continuing duty to monitor the impacts of incidental take resulting from their activities [50 CFR 402.14(i)(3)]. In doing so, the Federal agency must report the progress of the action and its impact on the species to the Service as specified below.

1. Supply the Service with an annual report, due by January 31 of each following year, that specifies:
 - a. acres of essential habitat that were managed and progress on annual habitat management goals;
 - b. acres of essential habitat that is currently in place;
 - c. any incidental take documented;
 - d. acres of essential habitat lost to minerals and geology development;

- e. acres of essential habitat lost to fuel breaks;
 - f. any changes made to the census protocol.
2. Progress on any terms and conditions implemented.
 3. Care must be taken in handling dead specimens that are found to preserve biological material in the best possible condition. Any dead specimens found should be placed in plastic bag and refrigerated as soon as possible following discovery. The finding of any dead specimen should be reported immediately to the Service's East Lansing Field Office.

We anticipate that the taking of no more than 5 Kirtland's warbler nests (along with all associated chicks and eggs) associated with annual census activities is reasonably certain to occur as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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Abbreviations

°C	Degrees Celsius
°F	Degrees Fahrenheit
Act	Endangered Species Act
CFR	Code of Federal Regulations
DNR	Department of Natural Resources
FERC	Federal Energy Regulatory Commission
FR	Federal Register
FY	Fiscal Year
LTA	Landtype Association
MA	Management Area
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MI	Michigan
MNFI	Michigan Natural Features Inventory
MRVD	Thousand Recreation Visitor Days
NEPA	National Environmental Policy Act
NF	National Forest
OHV	Off-highway Vehicle
PCE	Primary Constituent Elements
RNA	Research Natural Area
Service	U.S. Fish and Wildlife Service
TNC	The Nature Conservancy
USFS	United States Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Service

APPENDIX A

Piping plover Effects Analysis Tables

Appendix A. Piping plover effects analysis.

Management Elements		Environmental Impacts	Piping plover Exposure	Piping plover Response	Population Response ¹		
Range Management	grazing		no exposure				
	fencing						
	salting						
	hay					noise disturbance	
		soil compaction					
		maintain open habitat					
Timber Harvest	Road construction		no exposure				
	Skid roads & Log landings					(see New Construction under Transportation)	
						Tree removal	
	Even-aged	clear-cut					removal of forested habitat
							reforestation
							noise/physical disturbance
		thinning					remove trees/decrease stem density
							increase solar exposure
							noise/physical disturbance
	shelterwood					removal of forested habitat	
						noise/physical disturbance	
	Uneven-aged	individual or group selection					removal of forested habitat
							reduce vegetation clutter
							noise/physical disturbance
							increase solar exposure
	Barrens creation & restoration	Timber harvest					removal of forested habitat
			increase sunlight/edge habitat				
			noise/physical disturbance				
Prescribed burning			spread nonnative species				
Salvage harvest			(see Prescribed Burning under Fire Management)				
			removal of dead/dying trees killed by natural events (storms, insects)				
		noise/physical disturbance					
Hazard Tree Removal			removal of trees that pose a threat to human safety				
Firewood cutting			removal of individual standing dead trees and snags				

Management Elements			Environmental Impacts	Piping plover Exposure	Piping plover Response	Population Response ¹	
Recreation Management	trails (construction, operation, and maintenance)		loss of linear forest habitat	no exposure			
			decrease understory; canopy maintained	no exposure			
			increase erosion; runoff	no exposure			
			soil disturbance/compaction	all life stages	no measurable response expected		
			increase invasive species	indirect exposure only	no measurable response expected		
			increase noise/human presence	all life stages	human activities -> abandonment & subsequent death of eggs/chicks; increased predation	decrease numbers, reproduction, & range	
	Aquatic-based recreation		increase noise/human presence	no exposure			
	Construction of facilities/parking lots		loss of forest habitat	no exposure			
			increase erosion; runoff	no exposure			
			soil disturbance/compaction	all life stages	no measurable response expected		
			increase invasive species	indirect exposure only	no measurable response expected		
			increase noise/physical disturbance	indirect exposure only	human activities -> abandonment & subsequent death of eggs/chicks; increased predation	decrease numbers, reproduction, & range	
	Transportation Management	Construction	new construction	loss of forested habitat	no exposure		
				habitat fragmentation	no exposure		
increased erosion; runoff				no exposure			
spread nonnative species				no direct exposure; indirect exposure only	no measurable response expected due to S&G		
noise/physical disturbance				no direct exposure; indirect exposure only	no measurable response expected due to S&G		
upgrading/widening			loss of forested habitat	no exposure			
			habitat fragmentation	no exposure			
			increased erosion; runoff	no exposure			
			noise/physical disturbance	no direct exposure; indirect exposure only	no measurable response expected due to S&G		

Management Elements		Environmental Impacts	Piping plover Exposure	Piping plover Response	Population Response ¹	
Transportation Management (cont'd)	Operation	OML 1-2	increased human access	no direct exposure; indirect exposure only	no measurable response expected due to S&G	
			spread nonnative species	no direct exposure; indirect exposure only	no measurable response expected due to S&G	
			noise/physical disturbance	no direct exposure; indirect exposure only	no measurable response expected due to S&G	
		OML 3-5	habitat fragmentation	no exposure		
			increased human access	no direct exposure; indirect exposure only	no measurable response expected due to S&G	
			spread nonnative species	no direct exposure; indirect exposure only	no measurable response expected due to S&G	
	Decommissioning	noise/physical disturbance	no direct exposure; indirect exposure only	no measurable response expected due to S&G		
		reduce human presence & physical disturbance	no direct exposure; indirect exposure only	improved habitat conditions -> increased survivorship, enhanced reproduction	none to increase in numbers, reproduction, & range	
Maintenance	resurfacing	noise/physical disturbance	no exposure			
	roadside maintenance	noise/physical disturbance				
Fire Management	Hazardous fuels reduction	Mechanical methods	maintain natural openings and wildfire dependant habitats			
			removal of forested habitat (small fuel breaks to large timber harvests)			
			control/reduce NNIS			
			reduced size and intensity of wildfires			
			noise/physical disturbance			
	Prescribed burning (fuel breaks, openings maintenance)	(see Prescribed Burning below)				

Management Elements		Environmental Impacts	Piping plover Exposure	Piping plover Response	Population Response ¹
Fire Management (cont'd)	Prescribed Burning (low/moderate intensity; for multiple purposes)	Fire	reduced size and intensity of wildfires	no exposure	
			maintain natural openings/wildfire dependant habitats		
			altered insect community (increases and decreases possible)		
			snag destruction & creation (immediate or long-term from burning)		
			smoke/airborne particulate matter		
			control/reduce NNIS		
			reduced understory/clutter		
			noise/physical disturbance		
	Line control	(See Line control below)			
	Fire suppression	Line control (hand tool, tractor plow, blade) including water/foam application)	increased erosion; runoff		
			reduced size and intensity of wildfires		
			remove trees		
			temporary exposure of mineral soil		
		noise/physical disturbance			
Aerial detection		noise/physical disturbance			
Aerial control (helicopter application of water)	noise/physical disturbance				
		reduced size and intensity of wildfires			
Watershed	general aquatic habitat management	Apply BMPs	Protect/improve water quality	no exposure	
			Protect/improve riparian areas		
		Cooperate with FERC on operation of hydroelectric dams	stream habitat fragmentation & alteration		
			impoundments		
	Aquatic & riparian management & restoration		decrease runoff/sediment		
			improve natural riparian habitat		
			improve natural riparian habitat		
			improved flow/sinuosity		
			short-term increase noise/physical disturbance/human presence during construction		

Management Elements			Environmental Impacts	Piping plover Exposure	Piping plover Response	Population Response ¹
Pest Management	mechanical control (mowing, digging, pulling)		soil disturbance/compaction	indirect exposure only	no measurable response expected due to S&G	
			increase sunlight on forest floor	no exposure		
			increased biodiversity - long term	all life stages	improved habitat conditions -> increased survivorship, enhanced reproduction	increase in numbers, reproduction, & range
			increase noise/physical disturbance/human presence	no direct exposure; indirect exposure only	no measurable response expected due to S&G	
	chemical control (pesticides & herbicides)		overspray/non-target death	indirect exposure only	no measurable response expected due to S&G	
			decreased water quality		no measurable response expected due to S&G	
			increase noise/physical disturbance/human presence		no measurable response expected due to S&G	
			increased biodiversity - long term		improved habitat conditions -> increased survivorship, enhanced reproduction	increase in numbers, reproduction, & range
	biological control		effects on non-target species	indirect exposure only	no measurable response expected	
			increase biodiversity - long term		no measurable response expected	
Wildlife, Fish, & Sensitive Plant Management	manage wetlands	protect winter water sources	water sources maintained during winter	no exposure		
		provide large shallow water emergent wetlands	maintain/improve wetland habitats			
	Implement Recovery Plans		improve the status of the subject species	all life stages	implement recovery tasks -> increased breeding success & individual survivorship; may cause inadvertent nest abandonment & subsequent death of chicks/eggs; injury or death of all life stages	increase in numbers, reproduction, & range
	deer habitat-type management		decrease or increase localized deer numbers	no exposure		
	manage wildlife openings	Timber harvest	(see Barrens Creation under Timber)	no exposure		
		Prescribed Burning	(see Prescribed Burning under Fire)			

Management Elements		Environmental Impacts	Piping plover Exposure	Piping plover Response	Population Response ¹	
Minerals & Geology	Oil/gas development	Access roads	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)	
		Facilities construction	noise/physical disturbance	no exposure		
	Tree removal					
	habitat fragmentation					
	spread nonnative species					
	facilities operation	increase erosion; runoff				
		noise/physical disturbance				
	Gravel mining (no new pits expected)	facilities operation	increased human access			
			noise/physical disturbance			
			habitat fragmentation			
			spread nonnative species			
		facilities operation	increase erosion; runoff			

¹ Population in the Action Area only; as measured in reproduction, numbers, & distribution

S&G = standards and guidelines

APPENDIX B

Indiana bat Effects Analysis Tables

Appendix B. Indiana bat effects analysis.

Management Elements		Environmental Impacts	Indiana bat Exposure	Indiana bat Response	Population Response ¹		
Range Management	grazing		maintain open habitat	all life stages	maintenance of openings may improve roosting habitat; long-term increase in roost trees -> increase pup development and adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers	
	fencing		introduce artificial barriers	no exposure			
	salting		increase localized salt concentration	no exposure			
	hay		noise disturbance		all life stages	no measurable response expected	
			soil compaction		all life stages	no measurable response expected	
		maintain open habitat	all life stages	maintenance of openings may improve roosting habitat; long-term increase in roost trees -> increase pup development and adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers		
Timber Management	Road construction		(see New Construction under Transportation)	(see New Construction under Transportation)	(see New Construction under Transportation)	(see New Construction under Transportation)	
	Skid roads & Log landings		Tree removal	winter: no direct exposure, winter/summer: indirect exposure to all life stages; summer: limited direct exposure to males;	winter: none because of S&G summer indirect effects: undetectable in short-term due to S&G, long-term increase in roost trees -> increase pup development and adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure) summer direct effects: unlikely due to S&G; small possibility of direct injury or mortality to males/non-reproductive females from felling roost tree	range from no response to increase in reproduction & numbers range from no response to short-term reduction in reproduction	
			soil compaction	all life stages	no measurable response expected		
			removal of forested habitat	winter: no direct exposure, winter/summer: indirect exposure to all life stages; summer: limited direct exposure to males;	winter: none because of S&G, summer indirect effects: undetectable in short-term due to S&G, long-term increase in roost trees -> increase pup development & adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure) summer direct effects: generally unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	range from no response to increase in reproduction & numbers range from no response to short-term reduction in reproduction	
	Even-aged		noise/physical disturbance	summer harvest: limited direct exposure to males;	summer direct effects: generally unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	range from no response to short-term reduction in numbers	
			thinning	remove trees/decrease stem density	winter: no direct exposure, winter/summer: indirect exposure to all life stages; summer: limited direct exposure to males;	winter: none because of S&G, summer indirect effects: undetectable in short-term due to S&G, long-term increase in roost trees -> increase pup development & adult fitness (less time needed to care for young, better thermoregulatory conditions-->less torpor, lower metabolic expenditure) summer direct effects: generally unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	range from no response to increase in reproduction & numbers range from no response to short-term reduction in reproduction

Management Elements			Environmental Impacts	Indiana bat Exposure	Indiana bat Response	Population Response ¹
Timber Management (cont'd)	Even-aged (cont'd)	thinning (cont'd)	increase solar exposure	all life stages	improve in roosting habitat -> increase pup development & adult fitness (less time needed to care for young, better thermoregulatory conditions->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers
			noise/physical disturbance	summer harvest: limited direct exposure to males;	summer direct effects: generally unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	range from no response to short-term reduction in numbers
		shelterwood	(see clear-cut)	(see clear-cut)	(see clear-cut)	(see clear-cut)
	Uneven-aged	individual or group selection	removal of forested habitat	winter: no direct exposure, winter/summer: indirect exposure to all life stages; summer: limited direct exposure to males;	winter: none because of S&G, summer indirect effects: undetectable in short-term due to S&G, long-term increase in roost trees -> increase pup development & adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers
			reduce vegetation clutter	all life stages	improve travel/foraging habitat; response range from none to increases foraging success	range from no response to increase in reproduction & numbers
			noise/physical disturbance	summer: limited direct exposure to males	summer direct effects: unlikely due to S&G; small possibility of males permanently or temporarily abandoning the area	range from no response to short-term reduction in numbers
			increase solar exposure	all life stages	range from no response to improve in roosting habitat -> increase pup development & adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers
	Barrens creation & restoration	Timber harvest	removal of forested habitat	winter: no direct exposure, winter/summer: indirect exposure to all life stages; summer: limited direct exposure to males;	winter: none because of S&G, summer indirect effects: undetectable in short-term due to S&G, long-term increase in roost trees -> increase pup development and adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers
			noise/physical disturbance	summer harvest: limited direct exposure to males;	summer direct effects: unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	range from no response to short-term reduction in reproduction
		Prescribed burning	(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)
	Salvage harvest		removal of dead/dying trees killed by natural events (storms, insects)	winter: no direct exposure, winter/summer: indirect exposure to all life stages; summer: limited direct exposure to males	winter: none because of S&G, summer indirect effects: undetectable in short-term due to S&G, long-term increase in roost trees -> increase pup development & adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers
			noise/physical disturbance	summer harvest: limited direct exposure to males;	summer direct effects: generally unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	range from no response to short-term reduction in reproduction
			noise/physical disturbance	summer harvest: limited direct exposure to males;	summer direct effects: generally unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	range from no response to short-term reduction in numbers

Management Elements		Environmental Impacts	Indiana bat Exposure	Indiana bat Response	Population Response ¹
Timber Management (cont'd)	Hazard Tree Removal	removal of trees that pose a threat to human safety	winter: no exposure, winter/summer: indirect exposure to all life stages; summer: limited direct exposure to all life stages	no measurable response expected due to S&G	
	Firewood cutting	removal of individual standing dead trees and snags	winter: no exposure; summer: no direct exposure due to S&G; indirect exposure to all life stages	limited area of impact; no measurable response expected	
Recreation Management	Trails (construction, operation, and maintenance)	loss of linear forest habitat	all life stages	amount of habitat loss small and would not have a detectable impact on habitat; no measurable response expected	
		decrease understory; canopy maintained	all life stages	improve travel/foraging habitat; response range from none to increased foraging success	range from no response to increase in reproduction & numbers
		increase erosion; runoff	exposure extremely unlikely (S&G, small numbers of lbats potentially present, and small area of impact)		
		increase noise/human presence	exposure extremely unlikely (S&G, small numbers of lbats potentially present, and small area of impact)		
		increase invasive species	all life stages	no measurable response expected	
		soil disturbance/compaction	all life stages	no measurable response expected	
	Aquatic-based recreation	increase noise/human presence	exposure extremely unlikely (S&G, small numbers of lbats potentially present)		
	Construction & operation of facilities/parking lots	loss of forest habitat	exposure extremely unlikely (S&G, small numbers of lbats potentially present, and small area of impact)		
		increase erosion; runoff	exposure extremely unlikely (S&G, small numbers of lbats potentially present, and small area of impact)		
		increase noise/physical disturbance	exposure extremely unlikely (S&G, small numbers of lbats potentially present, and small area of impact)		
		increase invasive species	all life stages	no measurable response expected	
soil disturbance/compaction		all life stages	no measurable response expected		

Management Elements			Environmental Impacts	Indiana bat Exposure	Indiana bat Response	Population Response ¹
Transportation Management	Construction	new construction	loss of forested habitat	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)		
			habitat fragmentation	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)		
			noise/physical disturbance	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)		
			spread nonnative species	all life stages	no measurable response expected	
			increase erosion; runoff	no direct exposure (seasonal restrictions), indirect exposure all life stages	no measurable response expected due to S&G	
		upgrading/widening	loss of forested habitat	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)		
		upgrading/widening (cont'd)	habitat fragmentation	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)		
			noise/physical disturbance	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)		
			increase erosion; runoff	no direct exposure (seasonal restrictions), indirect exposure all life stages	no measurable response expected due to S&G	
	Operation	OML 1-2	increased human access	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)		
			spread nonnative species	all life stages	no measurable response expected	
			noise/physical disturbance	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)		

Management Elements			Environmental Impacts	Indiana bat Exposure	Indiana bat Response	Population Response ¹	
Transportation Management (cont'd)	Operation (cont'd)	OML 3-5	habitat fragmentation	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)			
			increased human access	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)			
			spread nonnative species	all life stages	no measurable response expected		
			noise/physical disturbance	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)			
	Decommissioning	reduce human presence & physical disturbance	all life stages	range from no response to improve in roosting habitat -> increase pup development & adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers		
	Maintenance	resurfacing	noise/physical disturbance	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)			
		roadside maintenance	noise/physical disturbance	exposure extremely unlikely (S&G, very small numbers of lbats potentially present, and small area of impact)			
Fire Management	Hazardous fuels reduction	Mechanical methods	maintain natural openings and wildfire dependant habitats	all life stages	range from no response to improve in roosting habitat -> increase pup development & adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers	
			removal of forested habitat (small fuel breaks to large timber harvests)	winter: no direct exposure, winter/summer: indirect exposure to all life stages; summer: limited direct exposure to males;	winter: none because of S&G, indirect effects: unmeasurable in short-term due to S&G, long-term range from no response to improvements to roosting habitat -> increase pup development & adult fitness (less time needed to care for young, better thermoregulatory conditions ->less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers	
			noise/physical disturbance	winter: no direct exposure; summer: limited direct exposure to males (primarily for Karner blue butterfly habitat management)	summer direct effects: unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	no response (limited area of impact)	
			reduced size and intensity of wildfires	all life stages	decreased snag creation offset by S&G and by fire-created snags; decreased fire-related mortality; reduced fire-related impacts on prey	no response (limited area of impact)	
			control/reduce NNIS	all life stages	no measurable response expected		
			Prescribed burning (fuel breaks, openings maintenance)	(see Prescribed Burning below)	(see Prescribed Burning below)	(see Prescribed Burning below)	(see Prescribed Burning below)

Management Elements			Environmental Impacts	Indiana bat Exposure	Indiana bat Response	Population Response ¹
Fire Management (cont'd)	Prescribed Burning (low/moderate intensity; for multiple purposes)	Fire	reduced size and intensity of wildfires	all life stages	decreased fire-related mortality; reduced fire-related impacts on prey abundance; decreased snag creation should be undetectable to Indiana bats	no response (limited area of impact)
			maintain natural openings/wildfire dependant habitats	all life stages	response range from none to improved foraging & roosting habitat -> increased pup development & increased adult fitness (less time needed to care for young, better thermoregulatory conditions -> less torpor, lower metabolic expenditure)	range from no response to increase in reproduction & numbers
			altered insect community (increases and decreases possible)	winter: no direct exposure; summer: limited direct exposure to males (primarily for Karner blue butterfly habitat management)	winter: none because of S&G, short-term decreases in prey availability -> force bats to use alternate -> decrease foraging efficiency -> decrease fitness; long-term increases will have the opposite effect	
			noise/physical disturbance	winter: no direct exposure; summer: limited direct exposure to males (primarily for Karner blue butterfly habitat management)	summer direct effects: unlikely due to S&G; small possibility of males/non-reproductive females permanently or temporarily abandoning the area	no response to short-term reduction in numbers
			smoke/airborne particulate matter	winter: no direct exposure; summer: limited direct exposure to males (primarily for Karner blue butterfly habitat management)	summer direct effects: unlikely due to S&G; small possibility of males/non-reproductive females permanently or temporarily abandoning the area; small possibility of male mortality or injury	no response to short-term reduction in numbers
			control/reduce NNIS	all life stages	no measurable response expected	
			reduced understory/clutter	all life stages	improve travel/foraging habitat; response range from none to increased foraging success	range from no response to increase in reproduction & numbers
			snag destruction & creation (immediate or long-term from burning)	winter: no direct exposure; winter/summer: indirect effects to all life stages; summer: limited direct exposure to males (primarily for Karner blue butterfly habitat management)	decreased snag creation should be undetectable to Indiana bats; increased snags improve roosting habitat -> increased pup development & increased adult fitness (less time needed to care for young, better thermoregulatory conditions -> less torpor, lower metabolic expenditure); summer direct effects unlikely due to S&G; small possibility of direct injury or mortality	range from no response to increase in reproduction & numbers; possible short-term reduction in number of males
	Line control	(See Line control)	(See Line control)	(See Line control)	(See Line control)	
	Fire suppression	Line control (hand tool, tractor plow, blade) including water/foam application)	increased erosion; runoff	winter: none, summer: limited direct exposure to all life stages	no measurable response expected due to S&G	
			reduced size and intensity of wildfires	all life stages	decreased snag creation should be undetectable to Indiana bats; decreased fire-related mortality; reduced fire-related impacts on prey abundance	no response (limited area of impact)
			temporary exposure of mineral soil	winter: none, summer: limited direct exposure to all life stages	no measurable response expected	
			remove trees	winter: none, summer: limited direct exposure to all life stages	summer direct effects: unlikely due to S&G; small possibility of males, females, young permanently or temporarily abandoning the area	range from no response to short-term reduction in numbers
			noise/physical disturbance	winter: none, summer: limited direct exposure to all life stages	summer direct effects: unlikely due to S&G; small possibility of males, females, young permanently or temporarily abandoning the area	range from no response to short-term reduction in numbers

Management Elements			Environmental Impacts	Indiana bat Exposure	Indiana bat Response	Population Response ¹
Fire Management (cont'd)	Fire suppression (cont'd)	Aerial detection	noise/physical disturbance	winter: none, summer: limited direct exposure to all life stages	no measurable response expected	
		Aerial control (helicopter application of water)	noise/physical disturbance	winter: none, summer: limited direct exposure to all life stages	no measurable response expected	
			reduced size and intensity of wildfires	all life stages	decreased snag creation should be undetectable to Indiana bats; decreased fire-related mortality; reduced fire-related impacts on prey abundance	no response (limited area of impact)
Watershed	general aquatic habitat management	Apply BMPs	Protect/improve water quality	all life stages	improve prey base, foraging habitat, & travel corridors; increased foraging success -> improved pup development and increased adult fitness	range from no response to increase in reproduction & numbers
			Protect/improve riparian areas	all life stages	improve foraging and roosting habitat; increased foraging success, improved pup development, increased adult fitness	range from no response to increase in reproduction & numbers
		Cooperate with FERC on operation of hydroelectric dams	stream habitat fragmentation & alteration	all life stages	reduced contaminant flow from the Great Lakes -> improved pup development, increased adult fitness; no detectable response in prey base	range from no response to increase in reproduction & numbers
			impoundments	all life stages	increased foraging habitat; increased foraging success -> improved pup development and increased adult fitness	range from no response to increase in reproduction & numbers
	Aquatic & riparian management & restoration		decrease runoff/sediment	all life stages	improve prey base, foraging habitat, & travel corridors; increased foraging success -> improved pup development and increased adult fitness	range from no response to increase in reproduction & numbers
			improve fish habitat	all life stages	no measurable response expected	
			improve natural riparian habitat	all life stages	improve foraging and roosting habitat; increased foraging success, improved pup development, increased adult fitness	range from no response to increase in reproduction & numbers
			improved flow/sinuosity	all life stages	improve prey base, foraging habitat, & travel corridors; increased foraging success -> improved pup development and increased adult fitness	range from no response to increase in reproduction & numbers
			short-term increase noise/physical disturbance/human presence during construction	winter: no direct exposure; summer: exposure unlikely due to small area of impact and S&G	no measurable response expected	
	Pest Management	mechanical control (mowing, digging, pulling)		soil disturbance/compaction	all life stages	very limited area affected; no measurable response expected
increase sunlight on forest floor				all life stages	very limited area affected; no measurable response expected	
increase noise/physical disturbance/human presence				winter: no exposure; summer: limited direct exposure to all life stages	very limited area affected; no measurable response expected	
increased biodiversity - long term				all life stages	very limited area affected; no measurable response expected	

Management Elements			Environmental Impacts	Indiana bat Exposure	Indiana bat Response	Population Response ¹
Pest Management (cont'd)	chemical control (pesticides & herbicides)		overspray/non-target death	winter: no direct exposure; winter/summer: limited indirect exposure on all life stages; summer; summer: limited direct exposure to all life stages	very limited area affected; no measurable response expected	
			decreased water quality	winter: no direct exposure; winter/summer: limited indirect exposure on all life stages; summer; summer: limited direct exposure to all life stages	very limited area affected; no measurable response expected	
			increase noise/physical disturbance/human presence	winter: no direct exposure; winter/summer: limited indirect exposure on all life stages; summer; summer: limited direct exposure to all life stages	very limited area affected; no measurable response expected	
			increased biodiversity - long	all life stages	very limited area affected; no measurable response expected	
	biological control		effects on non-target species	winter: no direct exposure; winter/summer: limited indirect exposure on all life stages; summer; summer: limited direct exposure to all life stages	very limited area affected; no measurable response expected	
			increase biodiversity - long	all life stages	very limited area affected; no measurable response expected	
Wildlife, Fish, & Sensitive Plant Management	manage wetlands	protect winter water sources	water sources maintained during winter	none		
		provide large shallow water emergent wetlands	maintain/improve wetland habitats	all life stages	improve foraging; increased foraging success -> improved pup development, increased adult fitness	range from no response to increase in reproduction & numbers
	Implement Recovery Plans		improve the status of the subject species	all life stages	implement recovery tasks -> increased breeding success & individual survivorship	increase in numbers, reproduction, & range
	deer habitat-type management		decrease or increase localized deer numbers	winter: no direct exposure; winter/summer: limited indirect exposure on all life stages; summer; summer: limited direct exposure to all life stages	no measurable response expected	
	manage wildlife openings	Tree removal	increase sunlight/edge habitat	all life stages	improve foraging and roosting habitat; improved pup development, increased adult fitness	range from no response to increase in reproduction & numbers
			short-term noise/physical disturbance	winter: no direct exposure; summer: limited direct exposure to males	summer direct effects: generally unlikely due to S&G; small possibility of males/non-reproductive females temporarily or permanently abandoning the area	
			loss of forested habitat	winter: no direct exposure; summer: limited direct exposure to males	summer direct effects: generally unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	no response expected (small area of impact)
			spread invasive species	all life stages	no measurable response expected	
		Prescribed Burning	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)

Management Elements			Environmental Impacts	Indiana bat Exposure	Indiana bat Response	Population Response ¹	
Minerals & Geology	Oil/gas development	Access roads	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)	
		Facilities construction	noise/physical disturbance	winter: no direct exposure; summer: limited exposure to males	winter: no direct exposure; summer: limited exposure to males	summer direct effects: generally unlikely due to S&G; small possibility of males/non-reproductive females temporarily or permanently abandoning the area	no response expected (small area of impact)
			Tree removal	winter: no direct exposure; summer/winter: indirect exposure to all life stages; summer: limited exposure to males	winter: no direct exposure; summer/winter: indirect exposure to all life stages; summer: limited exposure to males	winter: none because of S&G	
				small area of facilities should not have a measurable affect on habitat; no response	no response expected (small area of impact)		
				summer direct effects: generally unlikely due to S&G; small possibility of direct injury or mortality males/non-reproductive females from felling roost tree	no response expected (small area of impact)		
				habitat fragmentation	all life stages	fragmentation very limited in size, no response expected	
			spread nonnative species	all life stages	no measurable response expected		
	increase erosion; runoff	winter: no direct exposure; summer/winter: indirect exposure to all life stages; summer: limited exposure to males	limited area of impact plus S&G should reduce impacts to undetectable; no measurable response expected				
	facilities operation	noise/physical disturbance	winter: no direct exposure; summer: limited exposure to all life stages	winter: no direct exposure; summer: limited exposure to all life stages	level of activity at active sites expected to be sporadic & generally low; no response expected	no response expected (small area of impact)	
		increased human access	winter: no direct exposure; summer: limited exposure to all life stages	winter: no direct exposure; summer: limited exposure to all life stages	level of activity at active sites expected to be sporadic & generally low; no response expected	no response expected (small area of impact)	
	Gravel mining (no new pits expected)	facilities operation	noise/physical disturbance	winter: no direct exposure; summer: limited exposure to males	winter: no direct exposure; summer: limited exposure to males	summer direct effects: generally unlikely due to S&G; small possibility of males/non-reproductive females temporarily or permanently abandoning the area	no response expected (small area of impact)
			habitat fragmentation	all life stages	all life stages	small area of facilities should not have a measurable affect on habitat; no measurable response expected	
			spread nonnative species	all life stages	all life stages	no measurable response expected	
			increase erosion; runoff	winter: no direct exposure; summer: indirect exposure to all life stages; summer: limited exposure to males	winter: no direct exposure; summer: indirect exposure to all life stages; summer: limited exposure to males	limited area of impact plus S&G should reduce impacts to undetectable; no measurable response expected	

¹ Population in the Action Area only; as measured in reproduction, numbers, & distribution

S&G = standards and guidelines

APPENDIX C

Karner blue butterfly Effects Analysis Tables

Appendix C. Karner blue butterfly effects analysis.

Management Elements		Environmental Impacts	Karner blue butterfly Exposure	Karner blue butterfly Response	Population Response ¹	
Range Management	grazing		no exposure			
	fencing					
	salting					
	hay			noise disturbance		
		soil compaction				
		maintain open habitat				
Timber Management	Road construction		(see New Construction under Transportation)	(see New Construction under Transportation)	(see New Construction under Transportation)	
	Skid roads & Log landings		Tree removal	no exposure		
			soil compaction			
	Even-aged	clear-cut		no exposure		
					removal of forested habitat	
		thinning			noise/physical disturbance	
					remove trees/decrease stem density	
					increase solar exposure	
					noise/physical disturbance	
	shelterwood		same as clear-cut			
	Uneven-aged	individual or group selection		no exposure		
					removal of forested habitat	
					reduce vegetation clutter	
					noise/physical disturbance	
Barrens creation & restoration	Timber harvest		increase solar exposure			
			removal of forested habitat	all life stages	improve habitat -> improve survival of all life stages	increase in numbers, reproduction, & range
			increase sunlight/edge habitat	all life stages	improve habitat -> improve survival of all life stages	increase in numbers, reproduction, & range
			noise/physical disturbance	all life stages	larvae, eggs, & possibly adults may be crushed by humans or equipment	short-term decrease in reproduction & numbers
		spread nonnative species	all life stages	may degrade habitat -> decreased breeding success; some NNIS provide nectar sources for adults -> improve foraging	none	
	Prescribed burning		(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)	

Management Elements		Environmental Impacts	Karner blue butterfly Exposure	Karner blue butterfly Response	Population Response ¹
Timber Management (cont'd)	Salvage harvest	removal of dead/dying trees killed by natural events (storms, insects)	no exposure		
		noise/physical disturbance			
	Hazard Tree Removal	removal of trees that pose a threat to human safety	all life stages	limited area of impact; no measurable response expected	
	Firewood cutting	removal of individual standing dead trees and snags	no exposure		
Recreation Management	trails (construction, operation, and maintenance)	loss of linear forest habitat	all life stages	no measurable response expected due to S&G	
		decrease understory; canopy maintained	all life stages	no measurable response expected due to S&G	
		increase erosion; runoff	all life stages	no measurable response expected	
		soil disturbance/compaction	all life stages	no measurable response expected due to S&G	
		increase invasive species	all life stages	may degrade habitat -> decreased breeding success; some NNIS provide nectar sources for adults -> improve foraging	no response
		increase noise/human presence	all life stages	larvae, eggs, & possibly adults may be crushed by humans or vehicles	decrease in numbers, reproduction
	Aquatic-based recreation	increase noise/human presence	no exposure		
	Construction of facilities/parking lots	loss of forest habitat	no exposure		
		increase erosion; runoff			
		soil disturbance/compaction			
increase invasive species					
increase noise/physical disturbance					
Transportation Management	Construction	new construction	loss of forested habitat	no exposure	
			habitat fragmentation		
			increased erosion; runoff		
			spread nonnative species		
			noise/physical disturbance		
	upgrading/widening	loss of forested habitat	all life stages	no measurable response expected due to S&G	
		habitat fragmentation	all life stages	no measurable response expected due to S&G	
		increased erosion; runoff	all life stages	no measurable response expected	
noise/physical disturbance		all life stages	no measurable response expected due to S&G		

Management Elements			Environmental Impacts	Karner blue butterfly Exposure	Karner blue butterfly Response	Population Response ¹
Transportation Management (cont'd)	Operation	OML 1-2	increased human access	all life stages	no measurable response expected	
			spread nonnative species	all life stages	may degrade habitat -> decreased breeding success; some NNIS provide nectar sources for adults -> improve foraging	none
			noise/physical disturbance	all life stages	larvae, eggs, & possibly adults may be crushed by humans or vehicles	decrease in numbers, reproduction
		OML 3-5	habitat fragmentation	all life stages	no measurable response expected due to S&G	decrease in numbers, reproduction
			increased human access	all life stages	larvae, eggs, & possibly adults may be crushed by humans or vehicles	
			spread nonnative species	all life stages	may degrade habitat -> decreased breeding success; some NNIS provide nectar sources for adults -> improve foraging	none
	Decommissioning	noise/physical disturbance	all life stages	larvae, eggs, & possibly adults may be crushed by humans or vehicles	decrease in numbers, reproduction	
		reduce human presence & physical disturbance	all life stages	decrease habitat fragmentation -> improve adult survival		
Maintenance	resurfacing	noise/physical disturbance	all life stages	no measurable response expected		
	roadside maintenance	noise/physical disturbance	all life stages	no measurable response expected		
Fire Management	Hazardous fuels reduction	Mechanical methods	maintain natural openings and wildfire dependant habitats	all life stages	improve habitat -> improve survival of all life stages	increase in numbers, reproduction, & range
			removal of forested habitat (small fuel breaks to large timber harvests)	all life stages	no measurable response expected due to S&G	
			control/reduce NNIS	all life stages	increased native plants -> improve breeding & foraging habitat -> improve survival of all life stages	increase in numbers, reproduction, & range
			reduced size and intensity of wildfires	all life stages	may cause decrease in habitat -> decreased breeding and foraging opportunities -> fewer butterflies	decrease in numbers, reproduction, & range
			noise/physical disturbance	all life stages	larvae, eggs, & possibly adults may be crushed by humans or equipment	short-term decrease in reproduction & numbers
	Prescribed burning (fuel breaks, openings maintenance)	(see Prescribed Burning below)	(see Prescribed Burning below)	(see Prescribed Burning below)	(see Prescribed Burning below)	

Management Elements			Environmental Impacts	Karner blue butterfly Exposure	Karner blue butterfly Response	Population Response ¹
Fire Management (cont'd)	Prescribed Burning (low/moderate intensity; for multiple purposes)	Fire	reduced size and intensity of wildfires	all life stages	may cause decrease in habitat -> decreased breeding and foraging opportunities -> fewer butterflies	decrease in numbers, reproduction, & range
			maintain natural openings/wildfire dependant habitats	all life stages	short-term: larvae, eggs, & possibly adults may be crushed or burned; long-term improvement in habitat conditions may improve reproductive success	short-term loss/long-term increase in reproduction & numbers; increase in range
			altered insect community (increases and decreases possible)	all life stages	no measurable response expected	
			snag destruction & creation (immediate or long-term from burning)	all life stages	no measurable response expected	
			smoke/airborne particulate matter	all life stages	adults, larva, & eggs could suffocate	short-term decrease in reproduction & numbers
			control/reduce NNIS	all life stages	increased native plants -> improve breeding & foraging habitat -> improve survival of all life stages	increase in numbers, reproduction, & range
			reduced understory/clutter	all life stages	improve habitat -> improve survival of all life stages	increase in numbers, reproduction, & range
			noise/physical disturbance	all life stages	no measurable response expected	
	Line control	(See Line control below)	(See Line control below)	(See Line control below)	(See Line control below)	
	Fire suppression	Line control (hand tool, tractor plow, blade) including water/foam application)	increased erosion; runoff	all life stages	limited area of impact: no measurable response expected	
			reduced size and intensity of wildfires	all life stages	may cause decrease in habitat -> decreased breeding and foraging opportunities -> fewer butterflies	decrease in numbers, reproduction, & range
			remove trees	all life stages	limited area of impact: no measurable response expected	
			temporary exposure of mineral soil	all life stages	limited area of impact: no measurable response expected	
			noise/physical disturbance	all life stages	limited area of impact: no measurable response expected	
		Aerial detection	noise/physical disturbance	all life stages	no measurable response expected	
Aerial control (helicopter application of water)		noise/physical disturbance	all life stages	limited area of impact: no measurable response expected		
	reduced size and intensity of wildfires	all life stages	may cause decrease in habitat -> decreased breeding and foraging opportunities -> fewer butterflies	decrease in numbers, reproduction, & range		

Management Elements		Environmental Impacts	Karner blue butterfly Exposure	Karner blue butterfly Response	Population Response ¹	
Watershed	general aquatic habitat management	Apply BMPs	Protect/improve water quality	no exposure		
			Protect/improve riparian areas			
		Cooperate with FERC on operation of hydroelectric dams	stream habitat fragmentation & alteration			
			impoundments			
	Aquatic & riparian management & restoration		decrease runoff/sediment			
			improve fish habitat			
			improve natural riparian habitat			
			improved flow/sinuosity			
			short-term increase noise/physical disturbance/human presence during construction			
	Pest Management	mechanical control (mowing, digging, pulling)			soil disturbance/compaction	all life stages
increase sunlight on forest floor				all life stages	improve habitat -> improve survival of all life stages	increase in numbers, reproduction, & range
increased biodiversity - long term				all life stages	improve habitat -> improve survival of all life stages	increase in numbers, reproduction, & range
increase noise/physical disturbance/human presence				all life stages	no measurable response expected	
chemical control (pesticides & herbicides)			overspray/non-target death	no exposure		
			decreased water quality	no exposure		
			increase noise/physical disturbance/human presence	no exposure		
			increased biodiversity - long term	all life stages	improve habitat -> improve survival of all life stages	increase in numbers, reproduction, & range
biological control			effects on non-target species	all life stages	no measurable response expected	
			increase biodiversity - long term	all life stages	improve habitat -> improve survival of all life stages	increase in numbers, reproduction, & range

Management Elements		Environmental Impacts	Karner blue butterfly Exposure	Karner blue butterfly Response	Population Response ¹	
Wildlife, Fish, & Sensitive Plant Management	manage wetlands	protect winter water sources	water sources maintained during winter	no exposure		
		provide large shallow water emergent wetlands	maintain/improve wetland habitats	no exposure		
	Implement Recovery Plans		improve the status of the subject species	all life stages	implement recovery tasks -> increased reproductive success & survivorship; limited death of eggs/larvae from habitat management	increase in numbers, reproduction, & range
	deer habitat-type management		decrease or increase localized deer numbers	indirect exposure only	increased deer numbers -> increased herbivory on lupine -> death of eggs & larvae	decreased numbers, reproduction, and range
	manage wildlife openings	Timber harvest	(see Barrens Creation under Timber)	(see Barrens Creation under Timber)	(see Barrens Creation under Timber)	(see Barrens Creation under Timber)
		Prescribed Burning	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)
Minerals & Geology	Oil/gas development	Access roads	(see New Construction and OML 1-2 under Transportation)	no exposure		
		Facilities construction	noise/physical disturbance	no exposure		
			Tree removal			
			habitat fragmentation			
			spread nonnative species			
		increase erosion; runoff				
	facilities operation	noise/physical disturbance	no exposure			
		increased human access	no exposure			
	Gravel mining (no new pits expected)	facilities operation	noise/physical disturbance	no exposure		
			habitat fragmentation			
			spread nonnative species			
			increase erosion; runoff			

¹ Population in the Action Area only; as measured in reproduction, numbers, & distribution

S&G = standards and guidelines

APPENDIX D

Pitcher's thistle Effects Analysis Tables

Appendix D. Pitcher's thistle effects analysis.

Management Elements		Environmental Impacts	Pitcher's Thistle Exposure	Pitcher's Thistle Response	Population Response ¹		
Range Management	grazing		no exposure				
	fencing						
	salting						
	haying			noise disturbance			
		soil compaction					
		maintain open habitat					
Timber Management	Road construction		no exposure				
	Skid roads & Log landings			Tree removal			
				soil compaction			
	Even-aged	clear-cut			removal of forested habitat		
					noise/physical disturbance		
		thinning			remove trees/decrease stem density		
					increase solar exposure		
					noise/physical disturbance		
	shelterwood			same as clear-cut			
	Uneven-aged	individual or group selection			removal of forested habitat		
					reduce vegetation clutter		
					noise/physical disturbance		
					increase solar exposure		
	Barrens creation & restoration	Timber harvest			removal of forested habitat		
					increase sunlight/edge habitat		
					noise/physical disturbance		
				spread nonnative species			
Prescribed burning			(see Prescribed Burning under Fire Management)				
Salvage harvest			removal of dead/dying trees killed by natural events (storms, insects)				
			noise/physical disturbance				
Hazard Tree Removal			removal of trees that pose a threat to human safety				
Firewood cutting			removal of individual standing dead trees and snags				

Management Elements		Environmental Impacts	Pitcher's Thistle Exposure	Pitcher's Thistle Response	Population Response ¹	
Recreation Management	trails (construction, operation, and maintenance)	loss of linear forest habitat	no exposure			
		decrease understory; canopy maintained	no exposure			
		increase erosion; runoff	all life stages	decrease habitat availability/suitability -> decreased survival & reproduction, reduced range	decrease in numbers, reproduction, & range	
		soil disturbance/compaction	all life stages	decrease habitat availability/suitability -> decreased survival & reproduction, reduced range	decrease in numbers, reproduction, & range	
		increase invasive species	all life stages	decrease habitat availability/suitability -> decreased survival & reproduction, reduced range	decrease in numbers, reproduction, & range	
		increase noise/human presence	all life stages	human trampling of plants & habitat -> decreased survival & reproduction, reduced range	decrease in numbers, reproduction, & range	
	Aquatic-based recreation	increase noise/human presence	no exposure			
	Construction & operation of facilities/parking lots	loss of forest habitat	no exposure			
		increase erosion; runoff	no exposure			
		soil disturbance/compaction	no exposure			
		increase invasive species	no direct exposure; indirect exposure only	decrease habitat availability/suitability -> decreased survival & reproduction, reduced range	decrease in numbers, reproduction, & range	
increase noise/physical disturbance		no direct exposure; indirect exposure only	human trampling of plants & habitat -> decreased survival & reproduction, reduced range	decrease in numbers, reproduction, & range		
Transportation Management	Construction	new construction	loss of forested habitat	no exposure		
			habitat fragmentation	no exposure		
			increased erosion; runoff	no exposure		
			spread nonnative species	no direct exposure; indirect exposure only	no measurable response expected due to S&G	
			noise/physical disturbance	no direct exposure; indirect exposure only	no measurable response expected due to S&G	
		upgrading/widening	loss of forested habitat	no exposure		
			habitat fragmentation	no exposure		
			increased erosion; runoff	no exposure		
noise/physical disturbance	no direct exposure; indirect exposure only	no measurable response expected due to S&G				

Management Elements		Environmental Impacts	Pitcher's Thistle Exposure	Pitcher's Thistle Response	Population Response ¹	
Transportation Management (cont'd)	Operation	OML 1-2	increased human access	no direct exposure; indirect exposure only	See "Trails" under Recreation Management	
			spread nonnative species	no direct exposure; indirect exposure only	See "Trails" under Recreation Management	
			noise/physical disturbance	no direct exposure; indirect exposure only	See "Trails" under Recreation Management	
		OML 3-5	habitat fragmentation	no exposure		
			increased human access	no direct exposure; indirect exposure only	no measurable response expected	
			spread nonnative species	no direct exposure; indirect exposure only	no measurable response expected	
			noise/physical disturbance	no direct exposure; indirect exposure only	no measurable response expected	
	Decommissioning	reduce human presence & physical disturbance	no exposure			
	Maintenance	resurfacing	noise/physical disturbance	no exposure		
		roadside maintenance	noise/physical disturbance			
Fire Management	Hazardous fuels reduction	Mechanical methods	maintain natural openings and wildfire dependant habitats			
			removal of forested habitat (small fuel breaks to large timber harvests)			
			control/reduce NNIS			
			reduced size and intensity of wildfires			
			noise/physical disturbance			
	Prescribed burning (fuel breaks, openings maintenance)	(see Prescribed Burning below)				

Management Elements			Environmental Impacts	Pitcher's Thistle Exposure	Pitcher's Thistle Response	Population Response ¹
Fire Management (cont'd)	Prescribed Burning (low/moderate intensity; for multiple purposes)	Fire	reduced size and intensity of wildfires	no exposure		
			maintain natural openings/wildfire dependant habitats			
			altered insect community (increases and decreases possible)			
			snag destruction & creation (immediate or long-term from burning)			
			smoke/airborne particulate matter control/reduce NNIS			
			reduced understory/clutter			
			noise/physical disturbance			
			Line control		(See Line control below)	
	Fire suppression	Line control (hand tool, tractor plow, blade) including water/foam application)	increased erosion; runoff			
			reduced size and intensity of wildfires			
			remove trees			
			temporary exposure of mineral soil			
			noise/physical disturbance			
		Aerial detection	noise/physical disturbance			
		Aerial control (helicopter application of water)	noise/physical disturbance			
Watershed	general aquatic habitat management	Apply BMPs	Protect/improve water quality	no exposure		
			Protect/improve riparian areas			
		Cooperate with FERC on operation of hydroelectric dams	stream habitat fragmentation & alteration			
			impoundments			
	Aquatic & riparian management & restoration		decrease runoff/sediment			
			improve fish habitat			
			improve natural riparian habitat			
			improved flow/sinuosity			
		short-term increase noise/physical disturbance/human presence				

Management Elements			Environmental Impacts	Pitcher's Thistle Exposure	Pitcher's Thistle Response	Population Response ¹
Pest Management	mechanical control (mowing, digging, pulling)		soil disturbance/compaction	all life stages	no measurable response expected; limited activity	none
			increase sunlight on forest floor	no exposure		
			increased biodiversity - long term	all life stages	improved habitat conditions -> increased survivorship, enhanced reproduction	increase in numbers, reproduction, & range
			increase noise/physical disturbance/human presence	all life stages	human trampling of plants -> short-term decreased survival & reproduction	decrease in numbers & reproduction
	chemical control (pesticides & herbicides)		overspray/non-target death	indirect exposure only	no measurable response expected due to S&G	
			decreased water quality	no exposure		
			increase noise/physical disturbance/human presence	all life stages	human trampling of plants -> short-term decreased survival & reproduction	decrease in numbers & reproduction
			increased biodiversity - long term	all life stages	improved habitat conditions -> increased survivorship, enhanced reproduction	increase in numbers, reproduction, & range
	biological control		effects on non-target species	indirect exposure only	no measurable response expected	
			increase biodiversity - long term	indirect exposure only	no measurable response expected	
Wildlife, Fish, & Sensitive Plant Management	manage wetlands	protect winter water sources	water sources maintained during winter	no exposure		
		provide large shallow water emergent wetlands	maintain/improve wetland habitats			
	Implement Recovery Plans		improve the status of the subject species	all life stages	implement recovery tasks -> increased reproduction & individual survivorship	increased numbers, reproduction, and range
	deer habitat-type management		decrease or increase localized deer numbers	no exposure		
	manage wildlife openings	Timber harvest	(see Barrens Creation under Timber)	no exposure		
		Prescribed Burning	(see Prescribed Burning under Fire)			

Management Elements		Environmental Impacts	Pitcher's Thistle Exposure	Pitcher's Thistle Response	Population Response ¹
Minerals & Geology	Oil/gas development	Access roads	(see New Construction and OML 1-2 under Transportation)	no exposure	
		Facilities construction	noise/physical disturbance		
			Tree removal		
			habitat fragmentation		
			spread nonnative species		
		facilities operation	increase erosion; runoff		
	noise/physical disturbance				
	Gravel mining (no new pits expected)	facilities operation	increased human access		
			noise/physical disturbance		
			habitat fragmentation		
			spread nonnative species		
			increase erosion; runoff		

¹ Population in the Action Area only; as measured in reproduction, numbers, & distribution

S&G = standards and guidelines

APPENDIX E

Bald eagle Effects Analysis Tables

Appendix E. Bald eagle effects analysis.

Management Elements		Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹	
Range Management	grazing		maintain open habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	may provide foraging habitat -> increase survivorship for a few individuals	none expected
	fencing		introduce artificial barriers	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
	salting		increase localized salt concentration	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
	haying		noise disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	very limited area of activity; no measurable response expected	
			soil compaction	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			maintain open habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	may provide foraging habitat -> increase survivorship for a few individuals	none expected
Timber Management	Road construction		(see New Construction under Transportation)	(see New Construction under Transportation)	(see New Construction under Transportation)	
	Skid roads & Log landings		Tree removal	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			soil compaction	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	

Management Elements			Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹
Timber Management (cont'd)	Even-aged	clear-cut	removal of forested habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
		thinning	remove trees/decrease stem density	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			increase solar exposure	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
	shelterwood	(see clear-cut)	(see clear-cut)	(see clear-cut)	(see clear-cut)	
	Uneven-aged	individual or group selection	removal of forested habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			reduce vegetation clutter	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			increase solar exposure	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	

Management Elements			Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹
Timber Management (cont'd)	Barrens creation & restoration	Timber harvest	removal of forested habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			increase sunlight/edge habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			spread nonnative species	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
		Prescribed burning	(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)
	Salvage harvest		removal of dead/dying trees killed by natural events (storms, insects)	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
	Hazard Tree Removal		removal of trees that pose a threat to human safety	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
	Firewood cutting		removal of individual standing dead trees and snags	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	

Management Elements			Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹
Recreation Management	trails (construction, operation, and maintenance)		loss of linear forest habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			decrease understory; canopy maintained	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increase erosion; runoff	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			soil disturbance/compaction	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increase invasive species	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increase noise/human presence	no direct exposure to nests/chicks; exposure to adults & juveniles	nest area disturbance during critical period -> decreased adult foraging success or nest abandonment -> death of eggs or chicks	decreased numbers & reproduction
	Aquatic-based recreation		increase noise/human presence	limited exposure to all life stages	nest area disturbance during critical period -> decreased adult foraging success or nest abandonment -> death of eggs or chicks	decreased numbers & reproduction
	Construction & operation of facilities/parking lots		loss of forest habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increase erosion; runoff	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			soil disturbance/compaction	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increase invasive species	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
increase noise/physical disturbance			limited exposure to all life stages	nest area disturbance during critical period -> decreased adult foraging success or nest abandonment -> death of eggs or chicks	decreased numbers & reproduction	

Management Elements			Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹
Transportation Management	Construction	new construction	loss of forested habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			habitat fragmentation	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increased erosion; runoff	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			spread nonnative species	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
		upgrading/widening	loss of forested habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			habitat fragmentation	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increased erosion; runoff	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
	noise/physical disturbance		no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G		
	Operation	OML 1-2	increased human access	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			spread nonnative species	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	

Management Elements			Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹
Transportation Management (cont'd)	Operation (cont'd)	OML 3-5	habitat fragmentation	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increased human access	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	small number of individuals impacted -> none expected
			spread nonnative species	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
	Decommissioning	reduce human presence & physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	decrease human-related disturbance -> improved breeding success	increased reproduction & numbers	
	Maintenance	resurfacing	noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
roadside maintenance		noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G		
Fire Management	Hazardous fuels reduction	Mechanical methods	maintain natural openings and wildfire dependant habitats	exposure to all life stages unlikely		
			removal of forested habitat (small fuel breaks to large timber harvests)			
			control/reduce NNIS			
			reduced size and intensity of wildfires			
			noise/physical disturbance			
	Prescribed burning (fuel breaks, openings maintenance)	(see Prescribed Burning below)	(see Prescribed Burning below)	(see Prescribed Burning below)	(see Prescribed Burning below)	

Management Elements			Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹
Fire Management (cont'd)	Prescribed Burning (low/moderate intensity; for multiple purposes)	Fire	reduced size and intensity of wildfires	all life stages	no measurable response expected	
			maintain natural openings/wildfire dependant habitats	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			altered insect community (increases and decreases possible)	exposure to all life stages unlikely		
			snag destruction & creation (immediate or long-term from burning)	no direct exposure to nests/chicks; exposure to adults & juveniles	may create a few suitable roost trees -> no measurable response expected	none expected
			smoke/airborne particulate matter	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			control/reduce NNIS	all life stages	no measurable response expected	
			reduced understory/clutter	exposure to all life stages unlikely		
			noise/physical disturbance	exposure to all life stages unlikely		
	Line control	(See Line control below)	(See Line control below)	(See Line control below)	(See Line control below)	
	Fire suppression	Line control (hand tool, tractor plow, blade) including water/foam application)	increased erosion; runoff	exposure to all life stages unlikely		
			reduced size and intensity of wildfires			
			remove trees			
			temporary exposure of mineral soil			
noise/physical disturbance						

Management Elements			Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹
Fire Management (cont'd)	Fire suppression (cont'd)	Aerial detection	noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
		Aerial control (helicopter application of water)	noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			reduced size and intensity of wildfires	all life stages	no measurable response expected	
Watershed	general aquatic habitat management	Apply BMPs	Protect/improve water quality	no direct exposure to nests/chicks; exposure to adults & juveniles	improved foraging habitat -> increased survivorship, enhanced reproduction	increased numbers, & reproduction
			Protect/improve riparian areas	no direct exposure to nests/chicks; exposure to adults & juveniles	improved foraging and breeding habitat -> increased survivorship, enhanced reproduction	increased numbers, reproduction, & range
		Cooperate with FERC on operation of hydroelectric dams	stream habitat fragmentation & alteration	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			impoundments	no direct exposure to nests/chicks; exposure to adults & juveniles	improved foraging habitat -> increased survivorship, enhanced reproduction	increased numbers, & reproduction
	Aquatic & riparian management & restoration		decrease runoff/sediment	no direct exposure to nests/chicks; exposure to adults & juveniles	improved foraging habitat -> increased survivorship, enhanced reproduction	increased numbers, & reproduction
			improve fish habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	improved foraging and breeding habitat -> increased survivorship, enhanced reproduction	increased numbers, reproduction, & range
			improve natural riparian habitat	no direct exposure to nests/chicks; exposure to adults & juveniles	improved foraging and breeding habitat -> increased survivorship, enhanced reproduction	increased numbers, reproduction, & range
			improved flow/sinuosity	no direct exposure to nests/chicks; exposure to adults & juveniles	improved foraging habitat -> increased survivorship, enhanced reproduction	increased numbers, & reproduction
			short-term increase noise/physical disturbance or human presence during construction	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	

Management Elements			Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹
Pest Management	mechanical control (mowing, digging, pulling)		soil disturbance/compaction	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increase sunlight on forest floor	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increased biodiversity - long term	all life stages	no measurable response expected	
			increase noise/physical disturbance/human presence	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
	chemical control (pesticides & herbicides)		overspray/non-target death	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			decreased water quality	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			increase noise/physical disturbance/human presence	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			increased biodiversity - long term	all life stages	no measurable response expected	
	biological control		effects on non-target species	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increase biodiversity - long term	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
Wildlife, Fish, & Sensitive Plant Management	manage wetlands	protect winter water sources	water sources maintained during winter	limited exposure to adults & juveniles	no measurable response expected	
		provide large shallow water emergent wetlands	maintain/improve wetland habitats	no direct exposure to nests/chicks; exposure to adults & juveniles	supplement foraging habitat -> improved foraging -> increase survivorship; enhanced reproduction	
	Implement Recovery Plans		improve the status of the subject species	all life stages	implement recovery tasks -> increased breeding success & individual survivorship	increase in numbers, reproduction, & range
	deer habitat-type management		decrease or increase localized deer numbers	indirect exposure only	improve prey availability -> increased breeding success & individual survivorship; limited increase vehicular strikes when eagles feed on road-kill deer	increased numbers, reproduction, and range

Management Elements			Environmental Impacts	Bald eagle Exposure	Bald Eagle Response	Population Response ¹
Wildlife (cont'd)	manage wildlife openings	Timber harvest	(see Barrens Creation under Timber)	(see Barrens Creation under Timber)	(see Barrens Creation under Timber)	(see Barrens Creation under Timber)
		Prescribed Burning	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)
Minerals & Geology	Oil/gas development	Access roads	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)
		Facilities construction	noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			Tree removal	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			habitat fragmentation	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			spread nonnative species	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increase erosion; runoff	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			facilities operation	noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G
	increased human access	no direct exposure to nests/chicks; exposure to adults & juveniles		no measurable response expected due to S&G		
	Gravel mining (no new pits expected)	facilities operation	noise/physical disturbance	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	
			habitat fragmentation	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			spread nonnative species	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected	
			increase erosion; runoff	no direct exposure to nests/chicks; exposure to adults & juveniles	no measurable response expected due to S&G	

¹ Population in the Action Area only; as measured in reproduction, numbers, & distribution
S&G = standards and guidelines

APPENDIX F

Kirtland's warbler Effects Analysis Tables

Appendix F. Kirtland's warbler effects analysis.

Management Elements			Environmental Impacts	Kirtland's warbler Exposure	Kirtland's warbler Response	Population Response ¹	
Range Management	grazing		maintain open habitat	no exposure			
	fencing		introduce artificial barriers				
	salting		increase localized salt concentration				
	hay		noise disturbance				
		soil compaction					
		maintain open habitat					
Timber Management	Road construction		(see New Construction under Transportation)	(see New Construction under Transportation)	(see New Construction under Transportation)	(see New Construction under Transportation)	
	Skid roads & Log landings		Tree removal	indirect exposure only	no measurable response expected		
			soil compaction	indirect exposure only	no measurable response expected		
	Even-aged	clear-cut		removal of forested habitat	indirect exposure only	create breeding habitat -> increase breeding activity; sustain population	increase numbers, reproduction, & range
				reforestation	indirect exposure only	create breeding habitat -> increase breeding activity; sustain population	increase numbers, reproduction, & range
				noise/physical disturbance	no exposure		
		thinning		remove trees/decrease stem density	no exposure		
				increase solar exposure			
				noise/physical disturbance			
	shelterwood		removal of forested habitat	indirect exposure only	convert jack pine to unsuitable breeding habitat -> decrease local breeding activity	none	
			noise/physical disturbance	no exposure			
	Uneven-aged	individual or group selection		removal of forested habitat	no exposure		
				reduce vegetation clutter			
				noise/physical disturbance			
				increase solar exposure			
	Barrens creation & restoration	Timber harvest		removal of forested habitat	indirect exposure only	create breeding habitat -> increase breeding activity; sustain population	increase numbers, reproduction, & range
				increase sunlight/edge habitat	all life stages	no measurable response expected	
			noise/physical disturbance	no exposure			
			spread nonnative species	indirect exposure only	no measurable response expected		
Prescribed burning			(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)	(see Prescribed Burning under Fire Management)	
Salvage harvest			removal of dead/dying trees killed by natural events (storms, insects)	indirect exposure only	no detectable negative impacts expected due to S&G		
			noise/physical disturbance	no exposure			

Management Elements		Environmental Impacts	Kirtland's warbler Exposure	Kirtland's warbler Response	Population Response ¹	
Timber Management (cont'd)	Hazard Tree Removal		removal of trees that pose a threat to human safety	possible exposure	very limited area of impact; no measurable response expected	
	Firewood cutting		removal of individual standing dead trees and snags	indirect exposure only	reduce structural habitat diversity -> limited reduction of foraging & breeding success	none
Recreation Management	trails (construction, operation, and maintenance)		loss of linear forest habitat	all life stages	small area of impact; no measurable response expected	
			decrease understory; canopy maintained	all life stages	small area of impact; no measurable response expected	
			increase erosion; runoff	all life stages	no measurable response expected	
			soil disturbance/compaction	all life stages	no measurable response expected	
			increase invasive species	all life stages	increase habitat permeability to cowbirds -> decreased nesting success	decreased numbers & reproduction
			increase noise/human presence	all life stages	may cause localized disturbance to breeding birds or crush nests -> nest abandonment; short-term reduction in breeding success; injured or killed eggs/chicks	none to small reduction in numbers & reproduction
	Aquatic-based recreation		increase noise/human presence	no exposure		
	Construction of facilities/parking lots		loss of forest habitat	no exposure		
			increase erosion; runoff			
			soil disturbance/compaction			
			increase invasive species			
		increase noise/physical				
Transportation Management	Construction	new construction	loss of forested habitat	indirect exposure only	may cause loss of small area of breeding habitat -> small decrease in numbers of birds in stand	none to small reduction in numbers & reproduction
			habitat fragmentation	indirect exposure only	increase habitat permeability to cowbirds -> decreased nesting success	decreased numbers & reproduction
			increased erosion; runoff	indirect exposure only	no measurable response expected	
			spread nonnative species	indirect exposure only	increase habitat permeability to cowbirds -> decreased nesting success	decreased numbers & reproduction
			noise/physical disturbance	no exposure		
		upgrading/widening	loss of forested habitat	indirect exposure only	may cause loss of small area of breeding habitat -> small decrease in numbers of birds in stand	none to small reduction in numbers & reproduction
			habitat fragmentation	indirect exposure only	small area of impact; no measurable response expected	
			increased erosion; runoff	indirect exposure only	small area of impact; no measurable response expected	
noise/physical disturbance	no exposure					

Management Elements			Environmental Impacts	Kirtland's warbler Exposure	Kirtland's warbler Response	Population Response ¹
Transportation Management (cont'd)	Operation	OML 1-2	increased human access	indirect exposure only	may cause localized disturbance to breeding birds or crush nests -> nest abandonment; short-term reduction in breeding success; injured or killed eggs/chicks	none to small reduction in numbers & reproduction
			spread nonnative species	indirect exposure only	increase habitat permeability to cowbirds -> decreased nesting success	decreased numbers & reproduction
			noise/physical disturbance	indirect exposure only	may cause localized disturbance to breeding birds or crush nests -> nest abandonment; short-term reduction in breeding success; injured or killed eggs/chicks	none to small reduction in numbers & reproduction
		OML 3-5	habitat fragmentation	indirect exposure only	increase habitat permeability to cowbirds -> decreased nesting success	decreased numbers & reproduction
			increased human access	indirect exposure only	may cause localized disturbance to breeding birds or crush nests -> nest abandonment; short-term reduction in breeding success; injured or killed eggs/chicks	none to small reduction in numbers & reproduction
			spread nonnative species	indirect exposure only	increase habitat permeability to cowbirds -> decreased nesting success	decreased numbers & reproduction
	Decommissioning	reduce human presence & physical disturbance	indirect exposure only	improve habitat conditions -> increase breeding success	increase numbers, reproduction, & range	
	Maintenance	resurfacing	noise/physical disturbance	exposure unlikely		
		roadside maintenance	noise/physical disturbance	exposure unlikely		
	Fire Management	Hazardous fuels reduction	Mechanical methods	maintain natural openings and wildfire dependant habitats	all life stages	improve habitat conditions -> increase breeding success
removal of forested habitat (small fuel breaks to large timber harvests)				indirect exposure only	no measurable response expected due to S&G	
control/reduce NNIS				all life stages	no measurable response expected	
reduced size and intensity of wildfires				all life stages	limit the natural establishment of breeding habitat -> decrease breeding success	decreased numbers, reproduction, & range
noise/physical disturbance				no exposure		
Prescribed burning (fuel breaks, openings maintenance)		(see Prescribed Burning below)	(see Prescribed Burning below)	(see Prescribed Burning below)	(see Prescribed Burning below)	

Management Elements			Environmental Impacts	Kirtland's warbler Exposure	Kirtland's warbler Response	Population Response ¹
Fire Management (cont'd)	Prescribed Burning (low/moderate intensity; for multiple purposes)	Fire	reduced size and intensity of wildfires	all life stages	limit the natural establishment of breeding habitat -> decrease breeding success	decreased numbers, reproduction, & range
			maintain natural openings/wildfire dependant habitats	all life stages	improve habitat conditions -> increase breeding success	increase numbers, reproduction, & range
			altered insect community (increases and decreases possible)	no exposure		
			snag destruction & creation (immediate or long-term from burning)	indirect exposure only	no measurable response expected	
			smoke/airborne particulate matter	no exposure		
			control/reduce NNIS	all life stages	no measurable response expected	
			reduced understory/clutter	no exposure		
			noise/physical disturbance	no exposure		
	Line control	(See Line control below)	(See Line control below)	(See Line control below)	(See Line control below)	
	Fire suppression	Line control (hand tool, tractor plow, blade) including water/foam application)	increased erosion; runoff	indirect exposure only	no measurable response expected	
			reduced size and intensity of wildfires	all life stages	limit the natural establishment of breeding habitat -> decrease breeding success	decreased numbers, reproduction, & range
			remove trees	indirect exposure only	limit the natural establishment of breeding habitat -> decrease breeding success	none to small reduction in numbers & reproduction
			temporary exposure of mineral soil	indirect exposure only	no measurable response expected	
			noise/physical disturbance	indirect exposure only	no measurable response expected	
		Aerial detection	noise/physical disturbance	all life stages	no measurable response expected	
Aerial control (helicopter application of water)		noise/physical disturbance	all life stages	no measurable response expected		
		reduced size and intensity of wildfires	all life stages	limit the natural establishment of breeding habitat -> decrease breeding success	decreased numbers, reproduction, & range	
Watershed	general aquatic habitat management	Apply BMPs	Protect/improve water quality	no exposure		
			Protect/improve riparian areas			
		Cooperate with FERC on operation of hydroelectric dams	stream habitat fragmentation & alteration			
			impoundments			
	Aquatic & riparian management & restoration		decrease runoff/sediment	no exposure		
			improve fish habitat			
			improve natural riparian habitat			
			improved flow/sinuosity			
		short-term increase noise/physical disturbance/human presence during construction				

Management Elements			Environmental Impacts	Kirtland's warbler Exposure	Kirtland's warbler Response	Population Response ¹
Pest Management	mechanical control (mowing, digging, pulling)		soil disturbance/compaction	no exposure		
			increase sunlight on forest floor	no exposure		
			increased biodiversity - long term	all life stages	improve habitat conditions -> increase breeding success	increase numbers, reproduction, & range
			increase noise/physical disturbance/human presence	all life stages	no measurable response expected (cowbird control activities designed to avoid direct impacts to occupied habitat)	
	chemical control (pesticides & herbicides)		overspray/non-target death	no exposure		
			decreased water quality			
			increase noise/physical disturbance/human presence			
			increased biodiversity - long term			
	biological control		effects on non-target species	no exposure		
			increase biodiversity - long term			
Wildlife, Fish, & Sensitive Plant Management	manage wetlands	protect winter water sources	water sources maintained during winter	no exposure		
		provide large shallow water emergent wetlands	maintain/improve wetland habitats			
	Implement Recovery Plans		improve the status of the subject species	all life stages	implement recovery tasks -> increased breeding success & individual survivorship	increase in numbers, reproduction, & range
	deer habitat-type management		decrease or increase localized deer numbers	no exposure		
	manage wildlife openings	Timber harvest	(see Barrens Creation under Timber)	(see Barrens Creation under Timber)	(see Barrens Creation under Timber)	(see Barrens Creation under Timber)
		Prescribed Burning	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)	(see Prescribed Burning under Fire)

Management Elements		Environmental Impacts	Kirtland's warbler Exposure	Kirtland's warbler Response	Population Response ¹	
Minerals & Geology	Oil/gas development	Access roads	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)	(see New Construction and OML 1-2 under Transportation)
		Facilities construction	noise/physical disturbance	indirect exposure only	no measurable response expected due to S&G	
			Tree removal	indirect exposure only	no measurable response expected due to S&G	
			habitat fragmentation	indirect exposure only	no measurable response expected due to S&G	
			spread nonnative species	indirect exposure only	no measurable response expected due to S&G	
			increase erosion; runoff	indirect exposure only	no measurable response expected due to S&G	
	facilities operation	noise/physical disturbance	indirect exposure only	no measurable response expected due to S&G		
		increased human access	indirect exposure only	no measurable response expected due to S&G		
	Gravel mining (no new pits expected)	facilities operation	noise/physical disturbance	no exposure		
			habitat fragmentation			
			spread nonnative species			
			increase erosion; runoff			

¹ Population in the Action Area only; as measured in reproduction, numbers, & distribution

S&G = standards and guidelines