December 3, 2005

Mr. Hurston A. Nicholas
Forest Supervisor
Shawnee National Forest
50 Highway 145 South
Harrisburg, Illinois 62946

Dear Mr. Nicholas:

This letter transmits the Fish and Wildlife Service's (Service) Programmatic Biological Opinion for the proposed 2006 Forest Plan for the Shawnee National Forest (SNF), Illinois. This programmatic opinion addresses the effects of the proposed action (Revised Forest Plan) on the threatened Mead's milkweed (*Asclepias meadii*) and the endangered Indiana bat (*Myotis sodalis*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et. seq.). Your July 19, 2005, request for formal consultation was received on July 21, 2005.

The SNF provided the Service with a Programmatic Biological Assessment dated July 2005 and, subsequently revised September 2005, that assessed the effects of the Revised Forest Plan on both the Indiana bat and Mead's milkweed as well as the following listed species: gray bat (*Myotis grisescens*), bald eagle (*Haliaeetus leucocephalus*), least tern (*Sterna antillarum*), pallid sturgeon (*Scaphirhynchus albus*), fanshell mussel (*Cyprogenia stegaria*), fat pocketbook pearly mussel (*Potamilus capax*), pink mucket pearly mussel (*Lampsilis abrupta*) and orange-footed pearly mussel (*Plethobasus cooperianus*). We concur with your assessment that the proposed Revised Forest Plan is not likely to adversely affect the gray bat, bald eagle, least tern, pallid sturgeon, fanshell mussel, fat pocketbook pearly mussel, pink mucket pearly mussel, or orange-footed pearly mussel. Therefore, these species will not be discussed further.

This Programmatic Biological Opinion is based on information provided in the July/September 2005 Programmatic Biological Assessment, the January 2005 Proposed Land and Resource Management Plan, the January 2005 Draft Environmental Impact Statement for the Proposed Land and Resource Management Plan, conversations with your staff, electronic mail exchanges of information, your November 29, 2005, comments on the Draft Programmatic Biological Opinion, and other sources of information. A

complete administrative record of this consultation is on file at the Service's Marion, Illinois Ecological Services Field Office.

I want to thank you and your staff for the exceptional cooperation during the development of this biological opinion. Furthermore, I appreciate your commitment to the recovery of federally listed species on the SNF. I believe the 2006 Forest Plan will benefit the conservation status of all federally listed species on the SNF as well as other declining species.

If you have any questions or concerns about this consultation or the consultation process in general, please feel free to contact me or Mike Thomas of this office at 618/997-3344.

Sincerely,

/signed/

Joyce A. Collins
Assistant Field Supervisor

cc: IDNR (Kruse, Kath, Shimp)
USFS (Randy Moore – Regional Office)
USFWS (Nelson, Pruitt, Szymanski)

PROGRAMMATIC BIOLOGICAL OPINION

FOR THE

SHAWNEE NATIONAL FOREST

2006 FOREST PLAN

ILLINOIS

U.S. Fish and Wildlife Service
Marion, Illinois Ecological Services Field Office
8588 Route 148
Marion, Illinois 62959

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BIOLOGICAL OPINION

CONSULTATION HISTORY

Informal consultation on the 2006 Forest Plan began in 2002. The Fish and Wildlife Service (Service) provided a list of federally listed threatened and endangered species and information concerning preparation of a biological assessment in a letter dated June 6, 2002. A draft version of the Biological Assessment for the Revised Land and Resources Management Plan was provided to the Service for review on May 12, 2004. The Service met with Forest Service staff on May 27, 2004, to discuss comments on the draft Biological Assessment.

In June 2005, the Service, through the Department of the Interior, provided comments to the Forest Service regarding the Draft Environmental Impact Statement and Proposed Revised Land and Resource Management Plan. The Forest Service submitted a Programmatic Biological Assessment and requested initiation of formal consultation on July 19, 2005. The Service agreed to the request for initiation of formal consultation and requested additional information on August 17, 2005. The additional information was subsequently provided by mail and email with receipt of a Revised Programmatic Biological Assessment dated September 2005.

TIERED CONSULTATION APPROACH

To assess the landscape effects of the proposed actions and to facilitate the Shawnee National Forest's (SNF) section 7(a) (2) responsibilities, a tiered programmatic consultation approach will be implemented. The Tier I level is the review of how the overall goals and prescribed management in the 2006 Forest Plan will impact listed species over the life of the plan. The Tier 1 review will also assess the effects of the management activities (i.e., harvest, burning, etc.) the SNF will utilize to implement the plan on listed species. This programmatic biological opinion constitutes the Tier I level review.

The Tier 2 level is the review of how the site specific future actions will affect listed species. As individual projects are proposed under the 2006 Forest Plan, the SNF will do the following:

- Site-specific projects will incorporate all applicable standards and guidelines identified in the 2006 Forest Plan and all of the terms and conditions associated with the reasonable and prudent measures outlined in this opinion.

- Site-specific biological assessments (or biological evaluations) will be submitted to the Service. Site-specific biological assessments will tier to the programmatic documents. As such, much of the information regarding the life history of listed species and other information can be referred back to the appropriate pages in the programmatic documents (Tier 1). The status of the species should be updated as appropriate.

● Site-specific biological assessments will clearly describe the proposed action, identify the species that may be present and describe the site-specific effects of the project to the listed species that may be affected by the project.

● Site-specific biological assessments will contain a statement that identifies al applicable standards and guidelines, terms and conditions and other conservation-related commitments.

● Site-specific biological assessments will contain a statement indicating that the site-specific project is fully compliant with the Tier 1 Programmatic Biological Opinion.

● All site-specific biological assessments will contain the appropriate site-specific determination of effects (i.e., no effect, not likely to adversely affect, wholly beneficial effects, or likely to adversely affect).

● Site-specific biological assessments will provide the cumulative total of take (or surrogate measure to monitor take) that has occurred thus far under the Tier 1 consultation.

The Service will review the information provided by the SNF for each site-specific project. We will (1) confirm the species that may be affected, (2) assess how the action may affect the species, including ensuring that the level of effect is commensurate with the effects contemplated in the Program-level biological opinion, and (3) verify the tally of the cumulative total of incidental take that has occurred to date under the Forest Plan. During this review, if it is determined that an individual proposed project is not likely to adversely affect listed species, the Service will complete its documentation with a standard concurrence letter that refers to this Biological Opinion, the Tier 1 programmatic document (i.e., it "tiers" to it), and specifies that the Service concurs that the proposed project is not likely to adversely affect listed species or designated critical habitat. If it is determined that the proposed project is likely to adversely affect listed species or designated critical habitat, then the Service will complete a Tier 2 biological opinion with a project specific incidental take statement.

DESCRIPTION OF THE PROPOSED ACTION

The Forest Service proposes to revise the 1992 Amended Land and Resource Management Plan (1992 Amended Forest Plan) for the Shawnee National Forest (SNF or Forest). The 1992 Amended Forest Plan was a significant amendment to the 1986 Land and Resource Management Plan (1986 Forest Plan). The 2006 Revised Land and Resource Management Plan (2006 Forest Plan) has been undertaken in compliance with the law in order to review and improve the management of the SNF and to incorporate information that has been gained through monitoring and evaluation of the 1992 Amended Forest Plan.

The 2006 Forest Plan, along with applicable laws and regulations, will be used to guide all natural resource management activities on the SNF. It describes and specifies resource-management practices, levels of resource production and management and the availability and suitability of lands for resource management. The 2006 Forest Plan focuses on the decade 2006 through 2016 and may be amended as needed. It should be revised within 10 to 15 years of the date it is adopted. It does not include site-specific treatments and actions as these will be considered at the project level.

The SNF includes about 284,600 acres located in the southern tip of Illinois. The area is bordered on the east and south by the Ohio River and on the west by the Mississippi River. The Forest is divided into two Ranger Districts. The Mississippi Bluffs Ranger District is located on the west side of the SNF and includes portions of Jackson, Williamson, Union, Alexander and Pulaski Counties. The Hidden Springs Ranger District is located on the east side of the SNF and includes portions of Gallatin, Hardin, Johnson, Massac, Pope and Saline Counties.

The SNF offers a setting of hills, rock formations and outstanding bluffs and streams, as well as a broad diversity of plants and animals. The Forest was created about 70 years ago when much of the area was exhausted, abandoned farmland or heavily logged forest. Land was acquired, eroded fields and cutover areas were reforested, erosion was checked and the forest was protected from fire.

The Forest is located at the edge of the glaciated area at the integration-point of five regional ecotypes, which results in a broad diversity of flora and fauna and unique geological features. The Forest provides diverse habitats for endangered, threatened and sensitive species, as well as for game and non-game species. The Oakwood Bottoms Greentree Reservoir and Mississippi River floodplains provide important wetland habitats for migrating waterfowl in the Mississippi Flyway, as well as migrating shorebirds and wading birds.

The SNF contains some of the largest and most diverse blocks of mature hardwood forest, forest-interior habitat, bottomland forest and openland habitats in Illinois. Most of the Forest is comprised of native oaks and hickories, which provide excellent wildlife habitat. Non-native pines were planted in the early years of the Forest to control erosion on abandoned farm-fields and pine plantations are now common, especially on the east side of the Forest. The Forest contains seven congressionally-designated wilderness areas and six candidate wild and scenic rivers.

The proposed action is to implement a program of ecological restoration and resource management activities on the SNF that will insure perpetuation of healthy natural communities and provide a variety of goods and services through time on the SNF. During the NEPA process the SNF examined four alternatives in detail. Alternative 2 is the preferred alternative. This alternative is discussed in detail in the SNF Draft EIS for the Proposed Land and Resource Management Plan (USFS 2005d). Alternative 2 offers additional emphasis and revised guidance on: watershed protection; biological diversity;

management of recreational resources; forest health and sustainability; wilderness, roadless areas and candidate wild and scenic rivers; and land-ownership adjustment. Management activities, such as timber harvest and prescribed fire, are used to mimic ecological processes to attain and sustain a high diversity of habitats and species.

Forest Plan Goals, Objectives and Management Prescriptions

The 2006 Forest Plan has several goals established through the planning process. The goals are interrelated and provide a balance of public uses of the Forest.

Goal A - MULTIPLE-USE MANAGEMENT

The Forest will be managed with environmentally sensitive, socially responsive and scientifically sound management practices that are, whenever possible, adapted from and supported by local research. Within its natural-resource capabilities and long-term sustainability, the Forest will provide a balance of multiple uses and public benefits that best meet desires and expectations. Public funds will be invested appropriately in the management of the Forest, in accordance with laws and regulations. Multiple-use management practices and their standards will not be compromised to gain short-term monetary savings or to avoid a necessary investment in long-term public benefits.

Goal B – ECOSYSTEM MANAGEMENT

The resources of the Forest will be managed at an ecosystem and landscape scale in a manner that addresses the complex issue of biological diversity. This includes:

- Management, maintenance and restoration of ecosystems – rather than individual resources – emphasizing the conservation of biological diversity;
- Protection of unique and special ecosystems;
- Resource management that is environmentally sensitive and in harmony with the capability and sustainability of ecosystems;
- Balancing the complex interrelationships of people and natural resources;
- Integration of the desired values and uses of the land and its resources into management and research objectives; and,
- Collaboration with scientists and educators to test new ideas and technologies.

Goal C - PUBLIC RELATIONSHIPS

The Forest will continue to be responsive to the needs and values of the pubic and the public will continue to be involved in the management of the Forest through an ongoing dialogue. The principles of the National Environmental Policy Act and other legislation

will continue to guide the Forest Service in seeking the advice and counsel of all interested citizens. Management decisions and actions will consider the desires of the public-at-large, as well as the specific desires of citizen groups, commercial interests and government authorities. A public relations program will continue in coordination with other public and private organizations to reduce conflicts and resource damage.

Goal D – RECREATION MANAGEMENT

The Forest will continue to welcome all, providing a broad range of high-quality recreational opportunities and experiences. Use will be restricted only when essential to protect Forest resources and/or public health and safety and to provide the expected recreational experience.

The system trails on the Forest will be well-marked, mapped and maintained in order to provide for user safety and to protect natural resources. The Forest Service will be a partner with others who provide recreational opportunities in southern Illinois. Trails and recreational facilities will be managed cost-effectively to complement opportunities available on nearby private and public land.

The Forest will provide opportunities for visitors to learn about their environment, natural resources management and the Forest. Interpretive and informational programs will offer the opportunity to discuss issues and to learn and share experiences.

Goal E - VISUAL-RESOURCE MANAGEMENT

The effects of management practices and public use will often be observed in parts of the Forest. Roads and trails will be seen where they pass across hillsides or forest openings. Forest-openings for the benefit of wildlife or a campground will be seen occasionally, as well as some openings where trees have been removed and young trees are growing. However, even in those places where the results of human activity can be viewed, the Forest will work to blend the visual effects of the activity with the natural-appearing forest landscape.

Goal F - HERITAGE-RESOURCE MANAGEMENT

The Forest offers evidence of a rich cultural history that reflects our national heritage. Significant historical and archaeological sites enable all to better understand and appreciate our heritage. The Forest will continue to identify, evaluate and preserve these sites and, where appropriate, provide visitors access to them and interpretation. Other sites will require extensive protection and study. All eligible sites will be nominated for listing on the national register of historic places.

Goal G - SPECIAL-FEATURE MANAGEMENT

The Forest will preserve and maintain rare remnants of plant communities that were present in the region before European settlement. Unique natural environments, such as

national natural landmarks and other natural areas, will be managed to preserve and protect their special features.

Savannas, barrens, prairies, glades and other natural plant communities will be restored through active management programs. These efforts will be undertaken with the cooperation and participation of other interested groups, such as the Illinois Department of Natural Resources (IDNR), the Illinois Nature Preserves Commission, The Nature Conservancy, the Illinois Native Plant Society and universities and colleges.

Goal H - RESEARCH

The Forest will continue to play an active role in meeting research needs related to the ecosystems of the Forest, the interaction of people with their environment, and the long-term effects of management practices. The Forest will continue to facilitate and cooperate in research by universities and others and in the management of the Kaskaskia Experimental Forest and Dixon Springs Agricultural Center.

Goal I - CANDIDATE WILD AND SCENIC RIVER MANAGEMENT

Six streams on the Forest are candidates for inclusion in the national system of wild and scenic rivers: Hutchins Creek, Big Creek, Big Grand Pierre Creek, Lusk Creek, Bay Creek and the Big Muddy River. A quarter-mile corridor along each will be managed to retain the stream's eligibility for inclusion in the system. Any portion of the six rivers or creeks that falls within wilderness will be managed according to wilderness standards and guidelines. Management restrictions will apply only to National Forest System lands. Owners of private property on these streams will continue to enjoy their landowner rights.

Goal J - WILDERNESS MANAGEMENT

Seven areas on the Forest are congressionally-designated wilderness: Bald Knob, Clear Springs, Panther Den, Burden Falls, Bay Creek, Lusk Creek and Garden of the Gods. The Forest will provide in each wilderness the opportunity for solitude, challenge and primitive recreation, as described in the Wilderness Act and the Illinois Wilderness Act of 1990. Wilderness management will generally employ approaches and tools having the least effects on wilderness values.

Goal K - FOREST ECOSYSTEM HEALTH AND SUSTAINABILITY

A healthy and sustainable forest ecosystem is essential for maintaining biological diversity on the Forest. Most of the hardwood forests on the SNF will be large and relatively aged, providing old-growth forest conditions on much of the Forest. Maintaining the oak-hickory forest type based on the historic range of variability is important for biological diversity and wildlife habitat. The Forest will utilize various vegetation-management activities, such as landscape-level prescribed burning, timber harvesting and timber-stand improvement to help create and/or maintain the ecological

conditions necessary to regenerate and maintain the oak-hickory forest-type. Forest-wide diversity of vegetation-types is ensured by application of the management prescriptions.

Where vegetation management is allowed, non-native pine plantations will be converted to native hardwoods, emphasizing plantations within or adjacent to natural areas. The restoration of native ecosystems will increase the biodiversity of the Forest's ecosystems and regional landscapes.

Although this goal emphasizes the maintenance of a healthy and sustainable hardwood-forest ecosystem, the Forest may also produce some timber products as a by-product of vegetation-management activities. This would utilize a renewable forest resource and support the growing need for wood products in a manner that is environmentally sound and compatible with other uses.

The Forest will continue to cooperate with state and private forestry programs, the IDNR and university researchers to promote an integrated pest management program for the prevention and suppression of insect and pathogen infestations and non-native invasive species. A variety of integrated pest management techniques will be used.

Goal L - RANGE-RESOURCE MANAGEMENT

The range program will not be a major use of the Forest outside the Dixon Springs Agricultural Center. The Forest may use grazing to accomplish other goals such as research on wildlife habitat improvement. Mowing for hay may also be used to help achieve desired vegetation and wildlife-habitat objectives.

Goal M – WILDLIFE, FISH AND AT-RISK SPECIES MANAGEMENT

The Forest is home to hundreds of species of wildlife and fish. The Forest's wildlife and fisheries management program will maintain or enhance habitat for all native species and ensure the diversity of natural communities throughout the forest environment.

Special attention will be given to the protection and management of critical riparian, forest-interior, oak-hickory forest, wetland and large openland habitats. The Forest will actively manage to maintain these special habitats. Some vegetation management techniques that may be employed include prescribed burning, timber harvesting, timber stand improvement, mowing, disking and seeding. Wetland management may include some structural engineering to restore and maintain important hydrological conditions.

The Forest will be managed to enhance opportunities for both consumptive and non-consumptive uses of wildlife and fish. The Forest Service, in cooperation with many partners, will provide additional waterfowl and other migratory bird habitat along the Mississippi Flyway by expanding and renovating the Oakwood Bottoms Greentree Reservoir and restoring bottomland and riverine forests and wetlands in the Mississippi and Big Muddy Rivers floodplains.

Species that are endangered, threatened or sensitive, or whose viability is of special concern will be given necessary protection and special management to ensure their continued existence. This may include active vegetation and structural management to maintain or restore habitats as well as reestablishment of plants and animals on the Forest in cooperation with state and federal fish and wildlife management agencies.

Goal N - TRANSPORTATION-SYSTEM MANAGEMENT

The Forest will provide a system of roads and trails offering safe and efficient access for visitor use and enjoyment. In addition to enabling enjoyment of the Forest, the transportation system will provide safe and efficient administration of the Forest. Roads that are no longer needed will be decommissioned or used as a part of the trail system. User-developed trails not needed for the Forest trail system will be obliterated.

Goal O - SOIL, WATER, AIR MANAGEMENT

Soil, water and air resources are critical to the health and well-being of the Forest and natural environments of southern Illinois. Some of the most important areas on the Forest are the riparian zones of rivers, streams and lakes. These riparian ecosystems are characterized by abundant species-diversity, high densities of species and populations and ample productivity. Water quality is especially important in watersheds that supply municipal drinking water.

Soil productivity, water quality and the integrity of riparian ecosystems and water-supply watersheds will be maintained and/or enhanced through non-point water-pollution–control methods found in the best management practices supported by state and federal agencies and coordinated with the U.S. Environmental Protection Agency. These practices are incorporated into Forest-wide and specific management standards and guidelines, or incorporated by reference. Groundwater, lakes, rivers, streams, springs, wetlands and other bodies of water will be protected. Degraded aquatic and riparian ecosystems will be restored, as will the hydrologic condition of watersheds degraded by historic land uses.

Air quality will be maintained or improved through coordination with regulating agencies. Prescribed burning practices will ensure effective smoke management.

Goal P - GEOLOGY AND MINERALS MANAGEMENT

The geologic features contributing to the Forest's diversity are recognized for their scenic beauty and contribution to unique habitats for flora and fauna, and prized as a rich natural resource. The Forest contains many rock formations, waterfalls, caves, groundwater resources, extensive fault systems, igneous rock dikes and other evidence of past geological processes. These processes are also responsible in part for the existence of mineral resources that could be economically and domestically significant.

The Forest will protect and, in some instances, showcase unique geologic features to enhance public understanding, use and enjoyment. Mineral resource exploration, development and extraction will be considered and, if appropriate, approved. If approved, exploration, development and extraction activities will be conducted in an environmentally sound manner that mitigates adverse effects on the forest ecosystem. Unique ecosystems will not be disturbed. Land that is disturbed will be quickly reclaimed and restored.

Goal Q - LAND-OWNERSHIP MANAGEMENT

The highest priorities of the Forest's land-ownership adjustment program are providing for ecological restoration, protecting historic resources, reducing management costs and meeting the needs of the public. Acquisition of land that provides habitat for endangered, threatened or sensitive species will continue to be a prime consideration of land adjustment activities. Land consolidation will be sought in order to improve public benefits and reduce administrative costs and is especially important in congressionally-designated areas like wilderness.

Land-for-land exchanges will be considered when they meet the priorities for land ownership adjustment. Land exchanges involving isolated parcels of National Forest land will receive a higher consideration. The resolution of encroachments, title claims and boundary disputes will be stressed. National Forest land will be managed with emphasis given to protecting the rights of intermingled or adjoining private land and mineral owners, in recognition of the mutual benefits derived from being a good neighbor. Special-use permits that encumber use of National Forest land will receive site-specific analysis, considering not only environmental effects, but also the need to encumber the land and the relative benefits of the encumbrance.

Goal R - LAW ENFORCEMENT

The Forest will continue to inform the public regarding rules and regulations governing National Forest System lands. Forest Service law enforcement will continue to protect public safety and the resources of the Forest. Prevention of violations is the ultimate goal of law enforcement through proper engineering of facilities, public education and enforcement activities.

Goal S - FIRE MANAGEMENT

The Forest will manage fire-suppression resources to provide a safe, efficient, cost-effective organization that can ensure public and firefighter safety, protect property and resource values and reduce the wildfire risk to rural communities. Interagency cooperation among local, state, federal and other agency partners will continue to be incorporated in all aspects of the fire-management program.

Fire-use, the combination of prescribed and wildland fires, is applied on the landscape to restore and/or maintain desired vegetative communities, ecological processes and fire-

adapted ecosystems; and fire regimes, condition classes and desired fuel-loadings. All appropriate methods to manage fuels, including prescribed fire and mechanical and manual methods, will be utilized in support of Revised Plan objectives.

Goal T - HUMAN AND COMMUNITY DEVELOPMENT

The Forest will continue to be a partner in rural development. Forest Service management programs will provide products, opportunities and services that support economic growth and enhance the quality of rural life. The Forest will provide human-resource programs that offer education, employment and resource experience opportunities. Opportunities will be made available for individuals and volunteer organizations to become partners in the management of the Forest through volunteer and challenge cost-share programs.

Chapter V of the 2006 Forest Plan (USFS 2005c) contains Forest-wide standards and guidelines that apply to the entire SNF and specific standards and guidelines that apply to each management prescription area. These standards and guidelines are rules and policies that guide Forest management and indicate what is required to establish and maintain desired land conditions. Appendix A of this Biological Opinion includes all the standards and guidelines developed specifically for federally listed species.

MANAGEMENT AREAS - The 2006 Forest Plan has fifteen management areas with associated prescriptions (see Table 1) to provide direction to help achieve Forest-wide goals and objectives. Maps of the management areas are presented in the SNF's EIS for the 2006 Forest Plan and will not be included here.

Table 1. Management Area Assignment in the 2006 Forest Plan

Management Area	Total Acres	Percent of NFS Lands
Candidate Wild and Scenic River (CR)	14,600	5.1
Cave Valley Bird Area (CV)	2,000	0.7
Developed Recreational Area (DR)	1,600	0.6
Even-Aged Hardwood Forest (EH)	137,700	48.4
Heritage Resource Significant Site (HR)	3,300	1.2
Large Openland (LO)	3,700	1.3
Mature Hardwood Forest (MH)	24,900	8.7
Minimal Management (MM)	7,900	2.8
Mississippi & Ohio River Floodplains (MO)	8,700	3.0
Natural Area (NA)	15,400	5.4
Non-Motorized Recreational Area (NM)	6,900	2.4
Oakwood Bottoms Greentree Reservoir (OB)	4,700	1.7
Research Area (RA)	7,700	2.7
Water Supply Watershed (WW)	17,400	6.1
Wilderness (WD)	28,100	9.9
TOTAL	284,600	100.0

Description of Management Prescription Areas and Scheduled Management Practices

The following is a brief description of the Management Prescription Areas excerpted from the 2006 Forest Plan. A complete description can be found in Chapter V of the 2006 Forest Plan. The standards and guidelines for each management prescription area will not be included here, but can also be found in Chapter V of the 2006 Forest Plan (USFS 2005c).

Management Prescription Area CR protects and maintains land and resource conditions on approximately 14,600 acres along waterways recommended for study and possible inclusion in the national wild and scenic river system. Included within this prescription are National Forest System lands that lie one-quarter of a mile on either side of Bay Creek, Big Creek, Big Grand Pierre Creek, Hutchins Creek, Lusk Creek and the Big Muddy River. The free-flowing condition, water quality and outstanding remarkable values that qualified these stream-segments as candidate wild and scenic rivers are protected. Activities that may be seen include prescribed burning, logging, trails construction and maintenance, minor recreation facility construction and maintenance and non-native invasive species control.

Table 2. Scheduled Management Practices – Management Area CR

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Prescribed Burning - Landscape Scale site prep. for oak	Acres	2,512	2,512
Equestrian/Hiking Trail Construction	Miles	12	0

No other scheduled management practices. Specific practices needed to manage the river corridors to maintain their eligibility as potential wild and scenic rivers may be determined during Plan implementation.

Management Prescription Area CV provides for management of Swainson's and cerulean warblers and other non-game birds within the 2,000-acre Cave Valley/Cedar Creek area. The management emphasis is to enhance habitat for non-game bird species and provide non-motorized recreational opportunities for non-motorized recreation in a roaded, natural setting. Activities that may be seen include prescribed burning, trail construction and maintenance, non-native invasive species control and pond and waterhole maintenance.

Table 3. Scheduled Management Practices – Management Area CV

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Equestrian/Hiking Trail Construction	Miles	4	0

No other scheduled management practices. Specific practices needed to maintain wildlife habitat may be determined during plan implementation.

Management Prescription Area DR provides for facilities, services and settings designed for human activities and affects 1,600 acres. These facilities may include campgrounds, picnic areas, boat ramps, interpretive sites, overlooks, swimming areas and trailheads. Management emphasis is on services and facilities that best fill niches provided by the Forest. Management activities that may be seen include thinning and tree removal, lawn-mowing, trail and recreation facilities construction and maintenance and non-native invasive species control.

There are no scheduled management practices for Management Area DR. Maintenance, rehabilitation, or reduction in services at developed recreation sites will be determined during Plan implementation.

Management Prescription Area EH provides for the production of high quality hardwoods on 137,700 acres in a roaded-natural recreational setting. The management prescription provides for maintenance of the oak-hickory forest-type and ecological restoration of areas that have been planted with non-native pine. Management activities that may be seen include prescribed burning, logging, temporary road construction and maintenance, trail and recreation-area construction and maintenance, openings maintenance, pond maintenance and non-native invasive species control.

The following vegetation composition objectives apply:

Vegetation Condition	**Management Area**
Permanent Wildlife Openings	1-4%
Herbaceous Openland	1-2%[1]
Mixed Pine/Hardwood Types	0-10%
Hardwood Types	80-99%[2]

[1] All herbaceous openland may be managed to retain its natural open character. The composition objectives shown above are an estimate of the amount that actually can be attained.

[2] Oak hickory composition objectives vary by ecological units as listed below:
--Illinois Ozarks – 60-75% in uplands and 25-50% on low slopes and alluvial plains;
--Greater and Lesser Shawnee Hills LTA's 1, 2, 4, 5, 7 –70-90% in uplands and 30-90% on low slopes and alluvial plains;
--Greater and Lesser Shawnee Hills LTA's 3 and 6 –85-100% on uplands and 30-85% on low slopes and alluvial plains.

Table 4. Scheduled Management Practices – Management Area EH

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Timber Harvest			
- Hardwood Shelterwood	Acres	3,197	6,175
- Hardwood Shelterwood with reserves	Acres	1,500	3,000
- Pine Shelterwood with reserves	Acres	3,814	6,369
- Intermediate Treatments	Acres	263	172
Reforestation			
- Site prep for natural regeneration	Acres	6,326	8,116
- Planting	Acres	2,185	2,731
Timber Stand Improvement	Acres	1,300	8,511
Roads			
- Reconstruction	Miles	77	85
Equestrian/Hiking Trail Construction	Miles	122	0
Wildlife Habitat Improvement			
- Wildlife opening maintenance	Acres	658	658
Prescribed Burning			
- Site prep/brush disposal	Acres	11,970	19,776
- Landscape scale site prep for oak	Acres	43,228	43,228

Management Prescription Area HR provides for the preservation and protection of sites listed on the National Register of Historic places and other known significant sites. These sites occupy about 3,300 acres and include Millstone Bluff, the Illinois Iron Furnace, Battery Rock, Great Salt Springs, Fountain Bluff and Hamburg Hill. Management activities that may be seen include archaeological excavation, site interpretation, trail construction and maintenance, tree and shrub removal, prescribed burning, timber management and non-native invasive species control.

Table 5. Scheduled Management Practices – Management Area HR

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Equestrian/Hiking Trail Construction	Miles	1	0

No other scheduled management practices. Specific management practices to protect, evaluate, or interpret significant heritage resource sites, or for wildlife habitat improvement will be prescribed during Plan implementation.

Management Prescription Area LO provides for large, high-quality openlands of grassland and oldfield habitat, generally greater than 80 acres, in a roaded-natural setting. The large openlands encompass approximately 3,700 acres and are primarily mixtures of native and non-native grasslands, oldfields in a variety of generally early-successional conditions, some wildlife openings and some remnant, wooded fencerows. Management

activities that may be seen include prescribed burning, non-native invasive species control, plowing and disking, pond maintenance and trail and minor recreation construction.

Table 6. Scheduled Management Practices – Management Area LO

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Wildlife Habitat Improvement - Large openland maintenance	Acres	2,300	2,300
Prescribed Burning - Landscape scale site prep for oak	Acres	68	68
- Large openland management	Acres	9,200	9,200

Management Prescription Area MH provides for recreation, wildlife, soil and water protection and visual quality on 24,900 acres. This prescription provides habitat for wildlife requiring mature hardwood forest conditions. Management activities that may be seen include prescribed burning, logging, temporary road construction, opening maintenance, trail and recreation area construction and maintenance, pond maintenance and non-native invasive species control.

The following vegetation-composition objectives apply:

Vegetation Condition	**Management Area**
Permanent Wildlife Openings	0-4%
Herbaceous Openland	1-2%[1]
Mixed Pine/Hardwood Types	0-10%
Hardwood Types	80-85%[2]

[1] All herbaceous openland may be managed to retain its natural open character. The composition objectives shown above are an estimate of the amount that actually can be attained. Up to 80% of the opportunity areas composing the Big Barrens region of Pope and Massac Counties (the Burke Branch area) may be managed to enhance herbaceous open-land conditions.

[2] Oak hickory composition objectives vary by ecological units as listed below:
--Illinois Ozarks – 60-75% in uplands and 25-50% on low slopes and alluvial plains;
--Greater and Lesser Shawnee Hills LTA's 1, 2, 4, 5, 7 –70-90% in uplands and 30-90% on low slopes and alluvial plains;
--Greater and Lesser Shawnee Hills LTA's 3 and 6 –85-100% on uplands and 30-85% on low slopes and alluvial plains.

Table 7. Scheduled Management Practices – Management Area MH

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Reforestation			
- Site prep for natural regeneration	Acres	1,164	1,547
- Planting	Acres	481	955
Timber Stand Improvement	Acres	300	1,645
Roads			
- Reconstruction	Miles	17	20
Equestrian/Hiking Trail Construction	Miles	24	0
Wildlife Habitat Improvement			
- Wildlife opening maintenance	Acres	36	36
- Pine restoration to hardwoods	Acres	586	1,431
- Shelterwood for oak management	Acres	659	1,330
- Shelterwood with reserves	Acres	400	800
- Intermediate treatment	Acres	95	45
Prescribed Burning			
- Site prep/brush disposal	Acres	2,400	4,071
- Landscape scale site prep. for oak	Acres	11,431	11,431

Management Prescription Area MM provides for the protection and maintenance of environmental values and the health and safety of the public on 7,900 acres. Management activities and investments are at a minimal level. Management activities that may be seen include prescribed burning, logging, temporary road construction, opening maintenance, trail and recreation area construction and maintenance, pond maintenance and non-native invasive species control.

Table 8. Scheduled Management Practices – Management Area MM

Management Prescription/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probably in Second Decade
ATV/OHV Travelway Reconstruction	Miles	2	0
Prescribed Burning			
- Landscape scale site prep for oak	Acres	440	440

Management Prescription Area MO provides for wetland and floodplain management on 8,700 acres of the historic floodplains of the Mississippi and Ohio Rivers. The emphasis is to provide non-motorized dispersed recreational opportunities such as hiking, hunting and wildlife viewing. Management activities that may be seen include prescribed burning, temporary road construction and maintenance, trail and recreation area construction, maintenance or improvement, openings maintenance, and levee and dam construction and maintenance.

Table 9. Scheduled Management Practices – Management Area MO

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Reforestation - Planting	 Acres	 2,000	 2,000
Timber Stand Improvement	Acres	2,262	1,000
Prescribed Burning - Site prep/brush disposal - Landscape scale site prep for oak	 Acres Acres	 1,500 200	 1,500 200
Wetland Structures	Structures	10	10

No other scheduled management practices. Specific practices needed to manage for bottomland hardwoods and wetlands will be determined during Plan implementation.

Management Prescription Area NA provides for the preservation, protection and enhancement of the unique scientific, educational or natural values found on approximately 15,400 acres of research natural areas, national natural landmarks, geological areas, zoological areas and botanical areas. Management activities that may be seen include prescribed burning, tree and shrub removal, trail construction and maintenance and non-native invasive species control.

Table 10. Scheduled Management Practices – Management Area NA

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Equestrian/Hiking Trail Construction	Miles	3	0
Prescribed Burning - Landscape scale site prep for oak - Ecological for barrens in NA's	 Acres Acres	 611 30,000	 611 30,000

No other scheduled management practices. Specific practices needed to manage for bottomland hardwoods and wetlands will be determined during Plan implementation.

Management Prescription Area NM provides direction for the management of the Camp Hutchins and Ripple Hollow areas totaling approximately 6,900 acres. Management emphases are ecological integrity and non-motorized recreation. Camp Hutchins is a relatively undisturbed ecosystem adjoining the LaRue Pine Hills ecological area, the Clear Springs and Bald Knob wildernesses and Hutchins Creek, a candidate wild and scenic river. Ripple Hollow contains unique botanical resources as a significant barrens natural area. Management activities that may be seen include prescribed burning, logging, temporary road construction and maintenance, trail and recreation area construction, maintenance or improvement, wildlife-opening maintenance, pond maintenance, and non-native invasive species control.

Table 11. Scheduled Management Practices – Management Area NM

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Equestrian/Hiking Trail Construction	Miles	2	0
Prescribed Burning - Landscape scale site prep for oak	Acres	7,223	7,223

Management Prescription Area OB provides direction for a 4,700-acre bottomland forest ecosystem in the Mississippi River floodplain. The management emphasis is to provide flooded habitat for migratory and wintering waterfowl and other game and non-game species, including songbirds, raptors, reptiles and amphibians. Management activities that may be seen include prescribed burning; logging; temporary road construction and maintenance; opening maintenance; levee and dam construction and maintenance; and controlled flooding.

The following composition-objectives apply:

Species Composition	**Management Area**
Permanent Water Bodies	1%
Moist-soil Openings	2-4%
Bottomland Hardwood Types	91-95%[1]
Age-Class Distribution Objectives	Age 0-9 10-20%; Age 30-60 40-60%; Age 60-80 10-20%

[1] At least 60% oak types. This will be primarily pin oak with other oak species, such as cherrybark, chinquapin, and willow where appropriate.

Table 12. Scheduled Management Practices – Management Area OB

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Reforestation - Planting	Acres	1,500	1,500
Timber Stand Improvement	Acres	1,500	1,500
Prescribed burning - Site prep/brush disposal	Acres	1,500	1,500

Management Prescription Area RA provides for a variety of intensive research needs. The 7,700 acres managed under this prescription include the Kaskaskia Experimental Forest, Dixon Springs Experimental Station and the Palzo Reclamation Site. Management activities that may be seen include grazing, logging, surface-mine restoration, prescribed fire, intensive research, pond and building maintenance and non-native invasive species control.

Table 13. Scheduled Management Practices – Management Area RA

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Equestrian/Hiking Trail Construction	Miles	2	0

No other scheduled management Practices. Specific practices involved with research will be determined during Plan implementation.

Management Prescription Area WW provides for the protection of water quality in water-supply watersheds, including Kinkaid Lake, Cedar Lake and Lake of Egypt. A total of 17,400 acres are managed under this prescription. Management activities that may be seen include prescribed burning; temporary road construction and maintenance; openings maintenance; pond maintenance; and non-native invasive species control.

Table 14. Scheduled Management Practices – Management Area WW

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Equestrian/Hiking Trail Construction	Miles	5	0
Wildlife Habitat Improvement - Large openland maintenance	Acres	400	400
Prescribed Burning - Large openland management	Acres	1,600	1,600

No other scheduled management practices. Specific practices needed for management of water supply watersheds will be determined Plan implementation.

Management Prescription Area WD provides opportunities for challenge and solitude within the seven wilderness areas designated by Congress in the Illinois Wilderness Act of 1990: Bald Knob (5,786 acres), Bay Creek (2,769 acres), Burden Falls (3,687 acres), Clear Springs (4,769 acres), Garden of the Gods (3,996 acres), Lusk Creek (6,298 acres) and Panther Den (839 acres). The primary purpose of management is to encourage native ecosystems and to protect the wilderness character. Management activities that may be seen include fire suppression; prescribed burning; eradication of non-native exotic plants and control of non-native invasive species; and trail and support facility construction, reconstruction or maintenance.

Table 15. Scheduled Management Practices – Management Area WD

Management Practice/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Equestrian/Hiking Trail Construction	Miles	60	0

No other scheduled management Practices. Specific practices involved with research will be determined during Plan implementation.

Table 16. Scheduled Management Practices Forestwide – All Management Areas

Management Practices/Activity	Unit of Measure	Amount Proposed in First Decade	Amount Probable in Second Decade
Timber Harvest			
- Hardwood Shelterwood	Acres	3,197	6,175
- Hardwood Shelterwood with reserves [1]	Acres	1,500	3,000
- Pine Shelterwood with reserves	Acres	3,814	6,369
- Intermediate Treatments [2]	Acres	263	172
Reforestation			
- Site prep for natural regeneration	Acres	7,490	9,663
- Planting	Acres	6,166	7,186
Timber Stand Improvement	Acres	5,362	12,656
Roads			
- Reconstruction	Miles	94	105
- Obliteration [3]	Miles	20	20
Equestrian/Hiking Trail Construction [4]	Miles	235	0
Wildlife Habitat Improvement			
- Wildlife opening maintenance	Acres	700	700
- Large openland maintenance	Acres	2,700	2,700
- Pine restoration to hardwoods [5]	Acres	586	1,431
- Shelterwood for oak mgmt. [6]	Acres	659	1,330
- Shelterwood with reserves [7]	Acres	400	800
- Intermediate treatments [2]	Acres	95	45
Prescribed Burning			
- Site prep/brush disposal [8]	Acres	17,371	26,847
- Landscape scale site prep for oak[9]	Acres	66,218	66,218
- Ecological for barrens in NA's[10]	Acres	30,000	30,000
- Large openland mgmt. [11]	Acres	10,800	10,800
Wetland Structures	Structures	10	10

[1] Shelterwood with reserves primarily in forest interior blocks.
[2] Primarily in bottoms in forest interior blocks.
[3] Road obliteration may be performed in any management area where needed.
[4] Equestrian/Hiking trail construction allocations by management area are estimates based on the 1992 Plan and existing trail system.
[5] Pine restoration to native hardwoods on lands unsuited for timber management.
[6] Shelterwood for oak management on lands unsuited for timber management.
[7] Shelterwood with reserves in forest interior blocks on lands unsuited for timber management.
[8] Prescribed burning at time of harvest.
[9] Landscape scale burning for oak management.
[10] Three burns per decade on 10,000 acres of natural areas to maintain barrens ecosystems.
[11] Four burns per decade on 2,700 acres of large openland habitat.

Management Practices/Activities Proposed to Accomplish Forest Plan Goals and Objectives

Various types of management practices and activities are proposed to accomplish Forest Plan goals and objectives. These management activities are:

Timber Harvest/Management

Timber harvest methods that may be used include even-aged systems (i.e., clearcut, seed tree, shelterwood and shelterwood with reserves) and uneven-aged systems (i.e., group selection and single tree selection). Shelterwood and shelterwood with reserves will be the predominant methods of harvest. Intermediate treatments include release treatments, pre-commercial thinning, commercial thinning (thinning from above, thinning from below, mechanical thinning, restoration thinning, and selection thinning), improvement cuts and other timber stand improvement measures. Intermediate treatments are proposed in bottomlands for forest interior wildlife habitat management. Definitions of these methods can be found in the 2006 Forest Plan Appendix D (USFS 2005c). There are several standards and guidelines in the 2006 Forest Plan that direct how, when, and where all of these management activities can occur. Many of these harvest methods will require temporary roads, skid trails and landings.

Fire Management

Prescribed fire will be used to accomplish the goals and objectives of the 2006 Forest Plan. Prescribed fire can be broken into discrete components to analyze – fireline construction and pre-treatment work, ignition methods, burn, and mop-up methods. The standards and guidelines in the 2006 Forest Plan direct how, when and where burns can occur. Smoke-management guidelines have been developed by the Forest Service to reduce the atmospheric impacts of prescribed fire (USDA 1976, USFS 2005c). This system consists of five steps: (1) plotting the trajectory of the smoke; (2) identifying smoke-sensitive areas such as highways, airports, hospitals or schools; (3) identifying critical targets, i.e., targets close to the burn or those that already have an air-pollution problem; (4) determining the fuel-type to be burned, e.g., whether the fuel-load is light as with a mature pine-stand with a grass understory, or heavy as the logging slash following clearcutting; and (5) minimizing risk by burning under atmospheric conditions that hasten smoke dispersion, or by using appropriate firing techniques and timing to reduce smoke pollution (Van Lear and Waldrop 1989, USFS 2005c). Forest prescribed burning plans include smoke-management requirements that provide for smoke dissipation to meet state and Federal air-quality standards.

In accordance with the 2006 Forest Plan a fire-management plan is maintained which provides direction for wildfire prevention, detection and suppression and hazardous fuels reduction. The plan directs fire suppression activities including fireline construction, use of fire retardants, and post-fire activities to control erosion and to promote revegetation of burned areas. Agreements for fire detection and suppression on Forest lands by cooperating firefighting agencies must define suppression-action commensurate with established resource-management prescriptions and fire-plans.

Within wilderness areas, wildfire detection and suppression will be commensurate with the resource value to be protected and utilize the appropriate range of suppression

strategies available. Detection and suppression should be based on the potential threat to health, safety and adjacent property. All fire-suppression activities will be in accordance with established wilderness policy. This generally means that preference will be given to using methods and equipment that cause the least: 1) alteration of the wilderness landscape; 2) disturbance of the land surface; 3) disturbance to visitor solitude; 4) reduction of visibility during periods of visitor use; and 5) adverse effect on other air quality related values.

Integrated Pest Management

Pesticides may be used on a case by case basis on the SNF only if alternative analysis demonstrates that pesticide use is the most effective means to meet overall management objectives. Currently approved herbicides for right-of-way maintenance include: picloram; 2,4-D; 2,4-DP; triclopyr and dicamba. Other herbicides used on the Forest are primarily glyphosate for developed site housekeeping. The only insecticides used in the last ten years have been small quantities of commercially available insect spray to control mosquitoes and wasp infestations in recreation areas and administrative sites. The aquatic pesticide rotenone is proposed for pond maintenance activities.

Range Management

Range management will not be a major use of the forest outside the Dixon Springs Agricultural Center and is allowed for research purposes only. Grazing is prohibited on range or pasture within filter strips except as may be prescribed at the Dixon Springs Agricultural Center. Mowing and sale of hay is allowed as a vegetation and/or wildlife-habitat management tool.

Riparian Management

Riparian corridor (filter strip) and riparian-area Forest-wide standards and guidelines shall supersede other, less restrictive, management-prescription area standards and guidelines. Filter strips shall be established adjacent to lakes, wetlands, perennial streams, intermittent streams and ephemeral streams, except in the Oakwood Bottoms Greentree Reservoir and Mississippi and Ohio River Floodplains Management Prescription Areas. The width of filter strips along perennial and intermittent streams and lakes will be based on slope. The minimum width along perennial streams is 100 feet and along intermittent streams is 50 feet. The maximum width along perennial streams is 300 feet and along intermittent streams is 150 feet. The minimum filter-strip width along the edge of wetlands is 100 feet and along ephemeral streams is 25 feet. Riparian corridors are not part of the suitable timber base. In addition, no-surface occupancy for extraction of minerals is allowed within filter-strips.

Recreational Management

The SNF is enjoyed by many people for various recreational uses. Recreational facilities such as campgrounds, trails (motorized and non-motorized), trail heads, and picnic areas

will be maintained and/or constructed as necessary to meet documented demands of existing or targeted users. Maintenance includes general upkeep of the facilities, signs, and trails; mowing; and the removal of hazard trees.

Minerals Management

Exploration and/or development of oil, gas or minerals on the Forest can occur to some extent in all management areas except wilderness areas. Occasionally, temporary roads would be built associated with exploration and/or development. Removal of trees as part of temporary road construction and other developments could occur. Operations on these acres would require protection and/or avoidance of threatened and endangered species and their habitats according to Forest-wide standards and guidelines. Commercial borrow and reserve pits shall not be allowed. Based on past and current trends, few total acres would be affected.

Soil and Water Resource Management

Soil and water resource management activities such as water barring and other soil erosion control methods will be conducted across the SNF.

Special Use Permits

Special use permits primarily involving the construction and maintenance of utility rights-of-way or road access to private lands adjoining Forest Service lands will be issued as necessary.

Habitat Management Guidelines

In addition to various management activities, the SNF has developed habitat-management guidelines to provide for viable populations of all native species on the forest. These guidelines include the following:

1. Oak-hickory deciduous forest – Maintain a variety of age-classes of oak-hickory deciduous forest through active vegetation management in the Oakwood Bottoms Greentree Reservoir, even-aged hardwood forest, mature hardwood forest and natural area management prescription areas.
2. Barrens and other native grasslands – Maintain the diversity of native barrens and grasslands through active management in the even-aged hardwood forest, mature hardwood forest, large openland and natural area management prescription areas.
3. Mesic deciduous forests – Maintain or increase the acreage and diversity of mesic, deciduous forests through management or plant succession in the wilderness, non-motorized recreation area, candidate wild and scenic river, and portions of even-aged and mature hardwood forest management prescription areas.
4. Riparian deciduous forests – Maintain the quality and quantity of this habitat through Forest-wide standards and guidelines for filter-strip management, and

through the water-supply watershed, Mississippi and Ohio River floodplains and natural area management prescription areas.

5. Bottomland deciduous forests – Maintain or increase the ecological diversity and quantity of bottomland deciduous forests in the Oakwood Bottoms Greentree Reservoir, even-aged hardwood forest, Mississippi and Ohio River floodplains and candidate wild and scenic river management prescription areas.
6. Caves – Maintain the quality and diversity of cave habitats through the standards and guidelines for cave management.
7. Swamps – Improve or maintain the quality and quantity of swamp habitats through forest-wide riparian filter strip standards and guidelines and through the Mississippi and Ohio River floodplains and candidate wild and scenic river management prescription areas.
8. Cliffs – Maintain or improve the diversity of cliff habitats directly in the natural area management prescription area and indirectly in the Wilderness management prescription area.
9. Springs/seeps – Protect existing spring seeps and other water-areas critical to wildlife. Identify sites requiring protection prior to implementing adjacent resource management activities.
10. Streams – Improve or maintain the abundance and diversity of streams through the natural area and candidate wild and scenic river management prescription areas and forest-wide riparian filter-strip standards and guidelines.
11. Wetlands – Maintain or improve the overall diversity and abundance of wetland habitats in the Oakwood Bottoms Greentree Reservoir, Mississippi and Ohio Rivers floodplains, natural area and candidate wild and scenic river management prescription areas and through forest-wide riparian filter-strip standards and guidelines.
12. Snags and cavities – To ensure that a sufficient component of cavity trees and snags remain within the hardwood component following harvest and timber-stand improvement activities, a minimum number of cavity trees should be retained in clumps within the harvest area; one clump per five acres of regeneration. All snags should be retained except those that are safety hazards to equipment operators.

Table 17. Snag and cavity-tree objectives for upland habitat types under even-aged management

Tree Size	Cavity/Trees
Diameter greater than 19 inches	1/acre
Diameter 11 to 19 inches	4/acre
Diameter 10 inches or less	2/acre

Wildlife habitat management guidelines will also include management of forest-interior habitat. Forest interior management standards and guidelines proposed for implementation include the following (USFS 2005d):

- All areas that are at least one-mile-diameter in size (approximately 500 acres) and do not include power-lines, paved roads, levees and lakes can be considered for forest interior management objectives.

- Forest-wide interior management guidelines apply in all management areas and would be implemented to the extent possible as consistent with individual management areas objectives and standards and guidelines.

- Forest land 400 meters from edges (edges are paved or graveled country roads or higher road standard, levees, major power-line corridors and large reservoirs or lakes) is considered buffer area in the one-mile diameter area. Greater than about a quarter-mile from edges is interior habitat. Interior habitats would be assigned along major streams or ravine bottoms where possible in each individual interior unit.

- Management for large oak-hickory forests in portions of the interior habitats is important.

- Forest management to maintain oak-hickory forests should be concentrated in historical oak areas.

- Multi-species oak-hickory forests on oak sites should be featured with white, red and black oaks as major components of the overstory.

- Both hardwoods and pine should be included for management as interior habitat in these 1+ mile diameter forest areas.

- Frequent burning to promote oak-hickory regeneration and control shade tolerant competition could occur throughout both buffer and interior areas.

- Shelterwood, thinning, or improvement cutting should be used to help create conditions favorable for establishment of adequate oak regeneration on ridge tops and upper slopes, where consistent with management area objectives. On lower slopes and in ravine bottoms, thinning (commercial or non-commercial) could be used to increase sunlight for oak-hickory regeneration.

- Artificial regeneration can be used where natural regeneration is not adequate.

- Wildlife opening management in the interior habitat areas (greater than about a quarter-mile from hard edges) would be eliminated within each 1+ mile diameter area.

- Wildlife openings in buffer areas (within about a quarter-mile from edges) should be managed to reduce parasitism and predation effects on forest interior birds.

- This should include fall disking and plowing and planting of legumes and wheat cover crops, or native warm season grasses and shrubs.

- All mowing would occur after August 1st.

No more than two percent of the Forest should be managed in wildlife openings. Where openings are created, they should be one-half to ten acres, with an average size of three acres in upland areas. Non-native invasive species will not be planted or seeded in wildlife openings. Permanent wildlife openings will be maintained by prescribed burning, seeding, disking, mowing, hydro-axing, bulldozing and the use of soil amendments and herbicides.

Excessive vegetation in lakes and ponds should be controlled when it impedes the use-objective for the water body. Control may be mechanical, biological or chemical, and management practices such as aquatic weed control, use of selective pesticides and annual drawdown are allowed. Construction of ponds will be based on site-availability and analysis of anticipated recreational demand.

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.

The action area for the Forest Plan is the area that encapsulates the reach of all the direct and indirect environmental impacts of the project. That is, the area in which the biotic, chemical, and physical impacts to the environment that are anticipated to occur. The action area for the Forest Plan will encompasses the entire SNF proclamation boundary plus lands one mile outside of the proclamation boundary for SNF lands that abut the boundary.

The area indirectly affected by the action includes the area affected by noise, smoke and sediment transport from upland areas into streams that occur in response to activities on the SNF property. Activities such as timber harvest and road construction will generate noise. The level of noise generated will vary depending upon the methods and equipment being used or operated, but is not expected to reach outside the project boundary. As an example bulldozers and chainsaws run at full throttle are expected to produce low frequency noise, that at a half mile away is detected at the decibel level of normal conversation (de Hoop and Lalonde 2003). Prescribed fire will generate smoke that may drift short distances from the project area. Smoke dissipates into the air column and detectable levels are minimal at a distance of one mile from the fire. Similarly, sediment originating on SNF lands and entering an aquatic system is likely to be deposited a certain distance downstream, depending on velocity and mean particle size (Ritter et al. 1995). Based on channel morphology and velocity of streams on the SNF, sediment

particles would be expected to be deposited within one mile of the origination point under normal flow conditions. Thus, the action area encompasses the entire proclamation boundary and extends out 1 mile.

Mead=s milkweed (*Asclepias meadii*)

STATUS OF THE SPECIES

Species Description

Mead's milkweed *(Asclepias meadii)* is a late-successional perennial, rhizomatous herb found primarily in virgin tall grass prairies, prairie hay meadows, and glades (Tecic et al. 1998, USFWS 2003). Occasionally Mead's milkweed has been reported from prairie remnants, sandstone barrens, and sandstone ledges (Voight and Mohlenbrock 1964, Tecic et al. 1998). Seasonal growth begins in mid to late April with a single, slender, unbranched stalk, 20-40 cm (8-16 in) tall that is glabrous but covered with a whitish, waxy covering. Leaves are opposite with a herringbone venation, broadly ovate, 5-7.5 cm (2-3 in) long, 0.9-5 cm (3/8 – 2 in) wide, hairless and covered with a whitish, waxy covering. When in flower (late May to early June), a single umbel is located at the top of the stalk. The umbel is comprised of 6-15 greenish-cream colored flowers. Successful sexual reproduction results in green fruit pods in late June with mature seeds having formed by mid-October (Morgan 1980, Kurz and Bowles 1981, USFWS 2003).

Life History and Population Dynamics

Mead's milkweed is a late-successional prairie species (Bowles et al. 1998, Bowles and Bell 1998) that occurs in mesic to dry mesic upland tallgrass prairies (Freeman 1988, USFWS 2003) in full sun. The species may persist in a vegetative state in partial shade for long periods of time until destroyed by chance impacts from animals or pathogens. Mead's milkweed is also known from glade and barrens habitat (USFWS 2003). Mead's milkweed has low reproductive rates and does not produce flowers every year (Thurman and Hickey 1989). Betz (1989) found that flowering plants only produced seed pods approximately 6.4% of the time. In contrast, Kettle et al. (2000) determined pod formation at a rate of 15%. Further, some estimates have suggested successful fruit production may be as low as 15% (Kurz and Bowles 1981).

Mead's milkweed is an obligate out crossing species and is pollinated by insects. Pollen clusters together in pollinia, and its seeds are wind-dispersed from follicles (Betz and Lamp 1992, Betz et al. 1994, Tecic et al. 1998). Mead=s milkweed usually reaches reproductive maturity in three to eight years from seed under cultivated conditions (Betz 1989), but may require as long as 15 years (Bowles et al. 2001).

Slow maturation appears to be an important life-history strategy and has sustained the species in hay meadows where mowing results in the removal of fruits before they mature and release seeds (Bowles et al. 1998, Tecic et al. 1998). The establishment of seedlings

is often infrequent, but is essential for the establishment of new populations, and may be necessary for long term population viability (USFWS 2003). Mead's milkweed also spreads vegetatively producing ramets from underground rootstock. Underground rhizomes can grow to 1 m (39 in).

In southern portions of its range, Mead's milkweed begins flowering in late May and mid-June in the north (USFWS 2003). Stress from extreme events, such as drought, are known to cause flower loss, wilting, and may result in plants being reduced to sterile or juvenile conditions. Mead's milkweed, similar to many milkweeds species, is self-incompatible and sensitive to inbreeding depression. Self-incompatible species usually require out crossing between sexually compatible plants for production of viable seeds (Shannon and Wyatt 1986, Kahn and Morse 1991, Broyles and Wyatt 1993). As a result, inbreeding depression occurs in populations with very small numbers. It is believed that small populations of Mead's milkweed with low numbers of genotypes will have a reduced reproductive capacity. In fact, viable seeds have not been found in most populations east of Kansas and western Missouri. Seed production may also be reduced due to high rates of pod abortion and loss of pollinators.

Pollination in Mead's milkweed is carried out by small bumblebees and miner bees. Individual pollen grains adhere to each other in a paired mass referred to as pollinium. The pollinium is then transported by bees, which can retain the mass for up to 6 hours (Morse 1980). Following successful pollination and seed formation, seeds are then wind dispersed from follicles (Betz 1989, Betz and Lamp 1992, Betz et al. 1994). Wyatt and Broyles (1994) suggested that the slow turnover of pollinium, in addition to the flying capabilities of bees, contributes to long distance pollen transfer. Hayworth et al. (2001) concluded that long distance pollen transfer and wind dispersed seeds have likely resulted in the large neighborhood sizes and low levels of genetic variation observed across the range of this species.

Total reproductive success in Mead's milkweed is low (Betz 1989, Thurman and Hickey 1989, Bowles et al. 1998, Tecic et al. 1998) and the species has been extirpated from many sites in the eastern portion of its range. Additionally, many populations throughout the range are small and contain only a low number of individuals (Bowles et al. 1998, Tecic et al. 1998, Watson 1998), often consisting of genetic clones. Watson (1998) postulated that the species may remain dormant some years due to environmental factors. This theory is supported by the observations of Betz and Hohn (1978) who noted populations may fluctuate from year to year, with individual plants flowering successively for several years only to then disappear completely for a few years. This phenomenon has been observed in at least one southern Illinois population (Elizabeth Shimp, USFS, pers. comm. 2005).

Bowles et al. (1998) and Tecic et al. (1998) have reported a reduction in genetic diversity in prairie populations managed as hay meadows compared to those managed with prescribed fire. Currently, only two populations of Mead=s milkweed are known to reproduce sexually and produce viable seed on a regular basis: Rockefeller Prairie in Jefferson County, Kansas and the Weimer Hill igneous glade in Iron County, Missouri

(Bowles et al. 1998, Tecic et al. 1998). Both of these sites have been managed primarily through prescribed fire. Tecic et al. (1998) compared the genetic variability of plants at these two sites with plants from other populations in hay meadows and determined that the two fire-managed populations had more genotypes but fewer ramets than those on hay meadows. Observations by Bowles et al. (1998) also determined that while mowed sites had a higher density of ramets, burned sites had a larger proportion of flowering ramets. Therefore, burning is likely to promote flowering and enhance sexual reproduction, while mowing during the growing season prevents sexual reproduction and promotes vegetative spread (USFWS 2003).

Status and Distribution

Mead=s milkweed was federally listed as a threatened species on September 1, 1988 (53 FR: 33992-33995). The species formerly occurred in the eastern tallgrass prairie region of the central United States in Illinois, Indiana, Iowa, Kansas, Missouri, and Wisconsin but is now considered extirpated in Indiana and Wisconsin (USFWS 2003) and is threatened with extirpation in Iowa (Watson 1998). The species currently exists in approximately 171 extant populations (USFWS 2003) across 34 counties (Figure 1) in Illinois, Iowa, Missouri, and Kansas (Tecic et al. 1998). The majority of the remaining populations (75%) are now restricted to primarily Ahigh quality@ tall grass prairies and prairie hay meadows in the Osage Plains Physiographic Region in Kansas and Missouri, and on igneous glades in Iron and Reynolds counties, Missouri (Bowles et al. 1998, Tecic et al. 1998). The remaining populations occur in the Shawnee Hills of Illinois, the Southern Iowa Drift Plain in Iowa, the Glaciated Plains, Ozark Border, Ozark Springfield Plateau, and the Ozark-St. Francois Mountains of Missouri, and the Glaciated Physiographic Region of Kansas (USFWS 2003).

Rankings of these populations are provided in Table 18 and are based on habitat quality as well as population size and vigor. Rankings range from A to D with “A” being populations in high quality habitats, greater than 200 or more ramets and which exhibit sufficient recruitment to sustain the population. A rank of “D” are populations in poor quality habitats and less than 25 ramets or less than 100 ramets that have not produced/released viable seeds over a period of five years.

In Iowa, the species historically occurred on small, isolated prairie remnants that contain low to very low numbers of individual plants (Watson 1998). Watson (1998) surveyed six historic sites in 1998 and located the species at only the Woodside Prairie site. Although he found seven flowering plants that produced two mature pods, he concluded that “*Asclepias meadii* must at present be considered near the brink of extinction in Iowa” (Watson 1998). Later, Watson located the species at the Powell Prairie site (USFWS 2003).

In Illinois, only four extant native populations occur on four small glades in the Shawnee Hills physiographic region, Saline County (Schwegman 1987, Tecic et al. 1998). These occurrences are all within two miles of each other along a sandstone escarpment. Historically, the species is known to have occurred in Cook, Ford, Fulton, Hancock, Henderson, LaSalle, Menard, Peoria, and Saline counties (USFWS 2003). However,

according to Bowles et al. (2001) the species likely occurred throughout much of Illinois, but disappeared before being discovered. In 2001, the last remaining population of Mead's milkweed occurring in Ford County, consisting of one individual, was destroyed after a change in land ownership (Bowles et al. 2001 and Elizabeth Shimp, USFS, pers. comm. 2005).

According to Horner (2001) most populations of Mead's milkweed in Missouri occur on private lands and nearly half are in Benton and Tettis counties (USFWS 2003). A record from 1898 at Buzzard Mountain, Iron County, was apparently relocated, but recent searches have not located individuals. A new population was found in 2001 in Adair County, where the species was thought to be extirpated (USFWS 2003). In recent surveys of 35 prairie sites, only five sites had populations of Mead's milkweed (USFWS 2005).

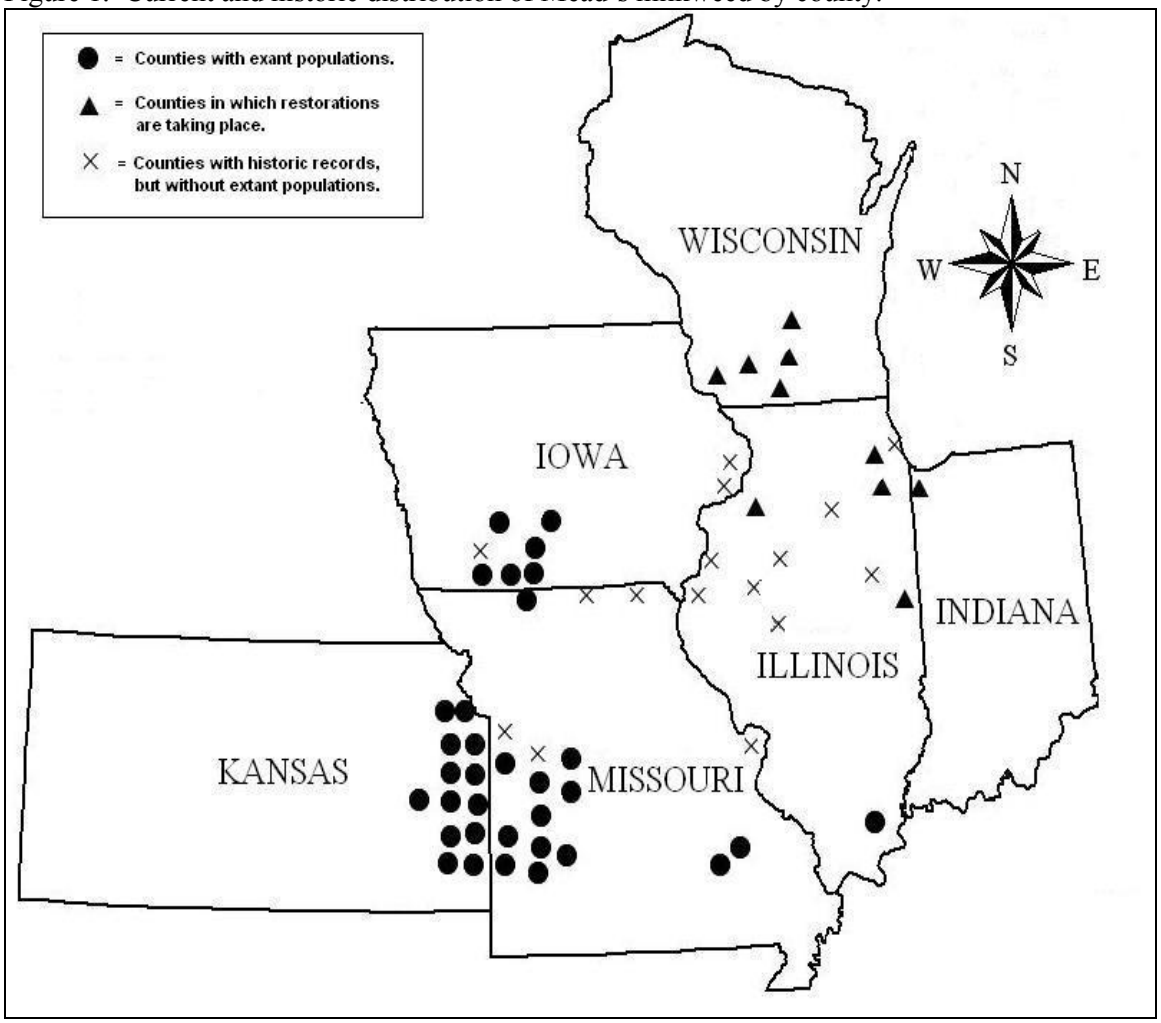
In Kansas there are approximately 101 known occurrences in 13 counties (USFWS 2003). The plant is not known to be extirpated from any county where it historically occurred, although several populations have been destroyed. Most of the Kansas populations were discovered after 1950, although one population is known from a pre-1900's record (Freeman 1988). A single report of the species from Harvey County, Kansas can not be verified and is probably inaccurate (USFWS 2003). Mead's milkweed sites in Kansas are predominantly managed as hay meadows (USFWS 2003).

Table 18. Natural Heritage ranking and number of extant natural Mead's milkweed populations by physiographic region and state. Ranking is based on population size and habitat integrity. A= >200 ramets, B=>100 ramets, C=>25 ramets, D=<25 ramets. (*From* U.S. Fish and Wildlife Service 2003). The Mead's milkweed population on the SNF is in the Shawnee Hills physiographic region.

Physiographic Region	**State**	**Number and rank of populations**					**Total**
		A	*B*	*C*	*D*	**Unknown**	
Unglaciated							
Osage plains (sandstone/chert)	Kansas	4	7	22	43	17	93
	Missouri	0	0	9	27	0	36
Ozark Border (chert)	Missouri	0	0	0	3	0	3
Ozark-Springfield Plateau (limestone)	Missouri	0	1	1	8	0	10
Ozark-St. Francois Mts. (igneous)	Missouri	1	0	1	5	0	7
Shawnee Hills (limestone)	Illinois	0	0	0	4	0	4
Driftless (dolomite)	Wisconsin	0	0	0	0	0	0
Glaciated (glacial stage)							
Glaciated Region (Kansan)	Kansas	1	1	0	4	2	8
Southern Iowa Drift Plain (Kansan)	Iowa	0	0	1	6	0	7
Glaciated Plains (Kansan)	Missouri	0	0	0	3	0	3
Western Forest Prairie (Illinoisan)	Illinois	0	0	0	0	0	0
Grand Prairie (Wisconsonian)	Illinois	0	0	0	0	0	0
	Indiana	0	0	0	0	0	0
TOTAL		6	9	34	103	19	171

A summary of Table 18, shows that out of 171 populations of Mead's milkweed across the range of the species, only 15 are in good to high quality habitat, with good or better viability. Most extant populations persist in poor quality habitat and/or have low viability.

Figure 1. Current and historic distribution of Mead's milkweed by county.



Threats

Mead's milkweed is threatened by the destruction and alteration of tallgrass prairie and glade/barren habitat or lack of active management through prescribed fire. Many locations where the species is previously known to have occurred have been destroyed by plowing and land development (Freeman 1988, Kurz and Bowles 1981). Many populations that were studied by Betz (1989) in 1965-1971, have been destroyed due to changes in management (i.e., use of herbicides instead of burning) for maintaining right-of-ways or other utility projects.

Private lands that are managed as hay meadows result in an altered population structure and reduction in genetic diversity and evolutionary potential. All but one of the Kansas milkweed populations occur on privately owned prairie hay meadows (Freeman 1988). Mowing of these prairies typically occurs in late June to early July (Brooks 1983, Freeman 1988), removing immature fruits and preventing completion of the plant's life cycle. Hay fields in Missouri with known populations of Mead's milkweed are managed under a similar regime. While public prairies have been acquired since the late 1970's, mowing has continued on these sites, but in rotation with burning and occasionally grazing (Smith 1997). In Iowa, only two Mead's milkweed sites are in public ownership and are being managed in a method compatible with the species' life cycle. The other Iowa sites are private hay meadows, pastures, and another is a right-of-way of an abandoned railroad prairie (USFWS 2003). In Illinois, extant populations of Mead's milkweed are protected on Forest Service land within Research Natural Areas, but suffer from lack of prescribed fire.

Reproductive isolation has occurred in many Mead's populations due to habitat fragmentation, even in Kansas and Missouri where populations are most numerous (Freeman 1988). Many of the smaller fragments still support low numbers of plants, but fragmentation is believed to have lead to the loss of genotypes and failure of these populations to produce viable seeds. In addition, in some populations the small number of plants may not attract pollinators in large enough numbers to ensure sexual reproduction. Furthermore, it has been speculated that the loss of habitat in some portions of the species' range have subsequently reduced pollinator populations (USFWS 2003). In addition, the Saline County, Illinois populations are threatened by encroachment of woody vegetation, trampling by hikers (Kurz and Bowles 1981 and Schwegman 1987) and theft. Other threats include predation, pathogens, herbivory (Garman and Alexander 2005), sexual incompatibility and stochastic events.

Many factors that hinder the recovery of Mead's milkweed may be overridden by the loss of genetic diversity. This may especially be true in eastern populations where the number of genotypes appears to be very low and in some cases is limited to one genotype per population. Active management is necessary to maintain Mead's milkweed populations. Research shows that prescribed fires are essential to successful reproduction and the long term survival of the species (Bowles et al. 1998, Tecic et al. 1998, Garman and Alexander 2005).

ENVIRONMENTAL BASELINE

Status of the Species within the Action Area

Mead's milkweed is found on the SNF in four locations. These four populations are located in three Research Natural Areas: Stoneface, Cave Hill, and Dennison Hollow, which are remnants of a larger population that has been fragmented by the encroachment of woody vegetation resulting from decades of fire suppression (USFWS 2003). Each of

these Mead's milkweed sites can all be characterized as barrens or glade habitat along sandstone ridges and blufftops.

All Mead's milkweed sites on the SNF are less than 0.1 hectares in size (Bowles 2001) and were last surveyed in May and June of 2005. The results of the 2005 survey are provided in Table 19. A total of 16 native plants were located, 15 of which were juveniles and one was a flowering adult (Elizabeth Shimp, SNF, pers. comm. 2005).

Table 19. Survey results for Mead's milkweed sites on the SNF on May 27 and June 16, 2005.

Site Name	Number of Natives	Number of Reintroduced	Number of Adults	Number of Juveniles	Number of Flowering
Stoneface Upper	2	0	0	2	0
Stoneface Lower	0	0	0	0	0
Dennison Hollow	12	0	1	11	1
Cave Hill	2	0	0	2	0
Total	16	0	1	15	1

Reintroductions have been carried out at each of the four sites on the SNF by the Morton Arboretum in conjunction with the Forest Service. Reintroductions began in 1991, although a setback occurred when some of the introduced plants were stolen and two juvenile native plants were cut to ground level in 1991 (Elizabeth Shimp, USFS, pers. comm. 2005, Stone 1991). According to Bowles et al. (2001) site reintroductions average about 60 plants per site with approximately 60% being one-year-old juveniles, and the remaining 40% planted seeds. Survivorship of reintroduced juveniles was recorded at 22.5%. Germination of reintroduced seeds was 18.5% with a 14.8% survival rate (Bowles et al. 2001). An introduction was attempted at a fifth site on the SNF in 2003, but no plants were found during the last census of the area in 2004 (Elizabeth Shimp, USFS, pers. comm. 2005).

Management of the Mead's milkweed sites began in the late 1980s at the Stoneface and Cave Hill areas. Management of these areas has included the removal of trees and shrubs and landscape scale prescribed fire. This management regime continued until 1995, after which only minor tree and shrub removal occurred at existing Mead's milkweed locations. Upon its discovery in July 1991, management of the Dennison Hollow population was primarily tree and shrub removal, although spot burning occurred in March 1992 (Elizabeth Shimp, USFS, pers. comm. 2005).

Survey results from 1983 to 2005 are summarized in Table 20 (Elizabeth Shimp, USFS, pers. comm. 2005). Results indicate a general decline in the number of Mead's milkweed individuals located on the SNF over the last decade. The number of individuals initially increased following the last prescribed burn in 1995. However, after almost a decade

without prescribed fire, the number of individuals has been generally declining since 1999. In addition, the number of flowering individuals also initially increased after 1995, but has also been in decline for the past several years.

Table 20. Survey results of Mead's milkweed on the SNF. Number of flowering plants is in parenthesis. A "-" indicates the site was unknown at the time. NA = Data Not Available (site was not censused or data not accessible at the time of this report.

Year Surveyed	Stoneface Lower	Cave Hill	Stoneface Upper	Dennison Hollow	Cave Hill Fire Tower	Total
1983	8(2)	8(1)	-	-	-	16(3)
1984	7(3)	7	3	-	-	17(3)
1985	6(2)	4	1	-	-	11(2)
1986	7(2)	4	1	-	-	12(2)
1987	9	8	1	-	-	18(0)
1988	7(2)	9(1)	1	-	-	17(3)
1989	3	6(1)	0	-	-	9(1)
1990	5(1)	7(1)	2	-	-	14(2)
1991	3	5(1)	2	5(1)	-	15(1)
1992	2	3	1	14(1)	-	20(1)
1993	4	2	2	14(1)	-	22(1)
1994	1	4	1	11(4)	-	17(4)
1995	0	NA	NA	NA	-	0(0)
1996	0	1	1	22(4)	-	24(4)
1997	1	NA	1	14(6)	-	16(6)
1998	1	5	0	20(7)	-	26(7)
1999	1	5	0	20(4+)	1	26(4+)
2000	0	NA	NA	5	-	5(0)
2001	0	3	1	12(2+)	-	16(2+)
2002	NA	NA	NA	NA	-	NA
2003	0	0	0	4	-	4(0)
2004	NA	NA	1	8	-	9(0)
2005	0	2	2	12(1)	-	16(1)

Table 21. Combined population viability of Mead's milkweed populations on the Shawnee National Forest.

Variable	Current Condition	Ranking: Definition of ranking
A. Population Size	15 Juveniles 1 Adult	0: < than 10 adults
B. Population Growth Trend	Decrease from 1995 to 2005	0: Decreased survivorship or growth
C. Effective Population Size (number of genotypes)	5 Genotypes	0: <10 Genotypes
D. Habitat Size	Each site is < 0.1 hectare, total size of all sites combined < 0.4 hectare	0: < 1 Hectare
E. Habitat condition/ successional stage	All sites in Natural Areas, lightly disturbed/late successional	3: Lightly disturbed or late successional
F. Protection status	On federal land/legal	3: Private or public ownership with legally binding protection
G. Management condition	Severe	0: Little human manipulation, but in severe need of fire to reduce woody encroachment
Total		6
PVI	(A+B+C+D+E+F+G)/21	0.285: Low viability is $\leq$ 0.50

Using the Determination of Population Viability Index (PVI) as detailed in the 2003 Mead's Milkweed Recovery Plan, the combined viability of the populations on the SNF has a PVI score of 0.29 (Table 4), which is considered low viability.

Previous Biological Opinions for Mead's Milkweed

In Region 3, only two biological opinions have been written for the Mead's milkweed. Both were for the Mark Twain National Forest (MTNF) and prepared by the Columbia Missouri Ecological Services Field Office. The first one was June 23, 1999 "Biological Opinion on the Impact of Forest Management and Other Activities to the Gray Bat, Bald Eagle, Indiana Bat, and Mead's Milkweed on the Mark Twain National Forest, Missouri." The Service concluded that the actions were not likely to jeopardize the continued existence of Mead's milkweed. Six conservation recommendations were provided in that biological opinion, including a recommendation to obtain approval to conduct prescribed burning in the Bell Mountain Wilderness. No action on that discretionary recommendation has been taken, therefore, the viability of that population continues to decline. The MTNF has continued to monitor the Bell Mountain Wilderness population and has provided the Service with annual reports.

The second biological opinion was the September 16, 2005, "Programmatic Biological Opinion for the Mark Twain National Forest 2005 Forest Plan." The Service concluded that the proposed Forest Plan and actions were not likely to jeopardize the continued existence of Mead's milkweed. Five conservation recommendations were provided in that biological opinion. Additional conservation recommendations were provided for the Bell Mountain Wilderness population of Mead's milkweed.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the species and its interrelated and interdependent activities. A Forest Plan level consultation requires two levels of analysis. The first level of the analysis will consider how the overall Forest Plan goals and objectives will affect listed species. The second level of the analysis will consider how the specific actions that implement the Forest Plan will affect the listed species.

Effects of the Implementation of the 2006 Forest Plan Goals and Objectives

As indicated in the Description of the Proposed Action, numerous goals have been established for the 2006 Forest Plan. These goals can be summarized as: 1) to promote ecosystem health and sustainability; and, 2) to provide a variety of uses, values, products and services. The only known populations of Mead's milkweed on the SNF are in designated Research Natural Areas (RNA) in Stoneface, Cave Hill, and Dennison Hollow. These RNA's are all managed under the Natural Areas (NA) management prescription area, which has a total acreage of 14,858 acres (USFS 2005b). Management activities that may be seen include prescribed burning, tree and shrub removal, trail construction and maintenance and non-native invasive species control.

The NA management prescription area designation protects the sites from human disturbance and directs management to the protection and management of natural communities including management to protect and improve habitat and ecological conditions for Mead's milkweed. Actions that have been taken include trail closure to equestrian and ATV use, closures on rock climbing and rapelling in the three RNA's, and water bar management on existing trails. These actions would continue and/or resume in the future with implementation of the 2006 Forest Plan and should have beneficial effects on the species.

In addition to the above, various administrative management activities will continue, including collection of pollen and/or seeds, introduction of seeds and plants and administrative protection of known sites. These activities are discussed in detail below. Administrative activities have had a beneficial effect on existing populations.

The overall goals and objectives of the 2006 Forest Plan for the SNF are consistent with the habitat needs of Mead's milkweed and, in general, implementation of the plan is anticipated to have only periodic, minor, negative fitness consequences to the species. Overall the plan is expected to improve the long term viability of the populations of Mead's milkweed on the SNF.

Effects of Implementation of the Types of Management Proposed to Accomplish Forest Plan Goals and Objectives

Direct and indirect effects to Mead's milkweed could occur with the implementation of the 2006 Forest Plan.

Administrative Management

Activities associated with administrative management may have direct and indirect effects on Mead's milkweed. Activities under this management regime include pollen and seed collection, captive breeding and growth, introduction of plants and seeds, administrative protection, and monitoring of populations and habitat. Many of these actions are being carried out in cooperation with the Morton Arboretum to produce juvenile plants and seeds for reintroduction. Direct mortality or injury may occur to wild plants during the collection of seeds and pollen. As a result, a range of responses is possible and include reduced reproductive success (damage to umbel and/or reduced flower/seed production) reduced growth or vigor (damage to stem during collection), and mortality (delayed from injury). The potential for injury and/or mortality during pollen and seed collection is considered to be very low given the experience level of the few individuals trained to carry out this action. Captive breeding and growth is carried out by the Morton Arboretum. Collection of individual plants from the SNF has not occurred and is not proposed under this action. Therefore, no negative fitness consequences are anticipated from this activity.

Introduction of plants and seeds is being carried out by the Morton Arboretum in conjunction with the Forest Service. Juvenile plants and seeds are produced in captivity and then transported to Mead's milkweed sites on the SNF and transplanted. Species responses to this action include injury and/or mortality during transport, transplant shock (resulting in reduced growth and/or mortality), increased seed and juvenile survival (transplanted individuals likely more robust than wild plants), improved reproductive success (earlier flowering and decreased chance of inbreeding depression), and increased population size. The benefits derived from this activity are anticipated to greatly outweigh any potential negative impacts.

Administrative protection is the protection of Mead's milkweed plants from theft and is primarily a law enforcement activity. Past actions have also included rerouting of trails. The effect of this action in the past has lead to no additional thefts. No negative effects are anticipated as a result of these activities. Beneficial effects will continue.

The following Mead's milkweed standard and guideline will be implemented to benefit Mead's milkweed:

> *1. Expand current populations into restored habitat through the use of propagated plants.*

Population and habitat monitoring is also a component of administrative management. Monitoring is carried out by trained individuals from the SNF, Illinois Department of Natural Resources (IDNR), or the Morton Arboretum. The potential adverse effects from this action are limited to accidental trampling during surveys. Trampling may cause damage to stems or leaves (injury), reduced growth and vigor, reduced reproduction (reduced flower/seed production), and mortality (rootstock dies after repeated above ground growth failure). However, the likelihood of trampling is very low due to the limited number of individuals who conduct the surveys and the amount of training individuals receive prior to surveying. Therefore, the anticipated negative impacts from this action are expected to be insignificant.

Recreation Management

Recreation management includes road and trail management and use, dispersed recreation and water bar construction. Populations of Mead's milkweed do not occur on roads or trails and no new roads or trails are proposed within Research Natural Areas. Therefore, road and trial management and use is not likely to result in negative fitness consequences for Mead's milkweed. However, several indirect effects are possible as a result of dispersed recreation.

Dispersed recreation may include cross county hiking, hunting, bird watching, and nature viewing. Since these activities are allowed in Natural Areas it is possible that individuals (e.g., hikers, hunters, etc) may trample Mead's milkweed, which could result in damage to stems or leaves (injury), reduced growth and vigor, reduced reproduction (damaged individuals may not produce flowers), and mortality (rootstock dies after repeated above

ground growth failure). Currently the likelihood of trampling is anticipated to be very low (insignificant) given the dispersed nature of these actions and large acreage available in relation to the small areas that are occupied by Mead's milkweed (each site is less than 0.1 ha). However, as management activities (e.g., prescribed burning) are implemented to improve/enhance the Mead's milkweed populations, the impacts of dispersed recreation are likely to increase.

The Forest has developed standards and guidelines to reduce/ameliorate the impacts associated with recreational management. This includes:

1. *Where impacts occur or are expected to occur as a result of recreational use adjacent to known populations, implement corrective actions as needed to avoid or stop the impact.*

With implementation of this standard, the potential for individual plants to be trampled during dispersed recreational activities is greatly reduced.

Road and trail maintenance includes: site access, surface hardening, and water bar placement. Access to road and trail maintenance sites could lead to trampling of individual plants in populations that occur near roads and trails. Trampling may cause damage to stems or leaves (injury), reduced growth and vigor, reduced reproduction (reduced flower/seed production), and mortality (rootstock dies after repeated above ground growth failure). However, this is expected to be minimal given that only one native population is located near trails.

In the past, one population has been negatively impacted by excessive water runoff and erosion from trails. Hardening of trail surfaces and placement of water bars is expected to reduce or eliminate erosion, which will have only positive benefits for individual Mead's milkweed plants. This could result in a range of responses including: improved growth and vigor, increased seed production, increased juvenile survival, and population increase. These beneficial effects would further reduce any negative fitness consequences associated with trampling during site access for maintenance activities.

Fire Management

Prescribed burns are proposed on 30,000 acres of barrens in Natural Areas during each 10 years of Forest Plan implementation. Large scale burns are proposed to accomplish several management objectives including restoration and maintenance of Mead's milkweed populations that depend on fire to reduce woody encroachment.

Prescribed fire can be broken into four components: fireline construction, ignition, burning, and mop-up operations. Fireline construction would remove surface fuels down to bear soil, primarily by hand raking or leaf blowing. Firelines are generally constructed along breaks such as streams, roads, and trails. Construction of firelines could have negative effects on Mead's milkweed if constructed during the growing season.

Individual plants could be trampled by fire crews or the above ground portion of the plant destroyed if an individual occurs within the line of construction.

Fuel ignition is usually preformed with drip torches and only occurs in a few locations. However, in some situations aerial ignitions will be accomplished with the release of a poly (plastic) material ping pong balls that are normally completely consumed by the chemical reaction that causes ignition. Ignition could cause injury or mortality if individual plants are ignited. The response of the species from either fireline construction or ignition could include damage to stems or leaves (injury), reduced growth and vigor, reduced reproduction (damaged individuals may not produce flowers), and/or mortality (rootstock dies after repeated failure of above ground growth).

Prescribed burns initially reduce above ground vegetation, improve light penetration, and improve soil conditions. The species response to burning includes improved growth/vigor, increased flower/seed production, improved seedling and juvenile survivorship, and increased population if burning is conducted during the dormant season. However, adverse effects to Mead's milkweed could occur if burning occurs during the growing season. The response of Mead's milkweed to a growing season burn could include damage to stems or leaves (injury), reduced growth and vigor, reduced reproduction (damaged individuals may not produce flowers), and/or mortality (seedlings have yet to develop deep roots).

The implementation of the following standard and guideline greatly reduces or eliminates the potential negative fitness consequences associated with prescribed burning.

1. *Manage and expand existing habitat through the use of prescribed burning and other management tools. Prescribed burns would take place between the end of October and the end of March (when dormant) to stimulate flowering.*

Mop-up operations are not anticipated to produce any negative fitness consequences to Mead's milkweed.

Other Vegetation Management

Other types of vegetation management in Natural Areas include tree and shrub removal. Timber harvest is not proposed in Research Natural Areas that have populations of Mead's milkweed. Therefore no effects to Mead's milkweed from timber harvest are anticipated.

Selective tree and shrub removal includes cutting and girdling. The purpose of this is to remove critical shading woody vegetation to improve light penetration and stimulate growth of barrens community plant species, including Mead's milkweed. The response of the species to this includes improved growth/vigor, increased flower/seed production, increased survivorship, and increased population. However, the potential exists for trampling or crushing of plants by personnel or falling vegetation. Species response to this action could include damage to stems or leaves (injury), reduced growth and vigor,

reduced reproduction (reduced flower/seed production), and mortality (rootstock dies after repeated above ground growth failure). While the likelihood of trampling or crushing of individual plants cannot be ruled out, impacts should be small provided personnel are adequately trained. In addition, the potential positive fitness consequences to this species from tree and shrub removal should offset the potential for occasional negative effects.

The following standard and guideline will be implemented to benefit Mead's milkweed.

1. Remove critical shading trees and shrubs as needed to perpetuate the species.

Integrated Pest Management

Integrated pest management may include a mix of biological, chemical, and manual/mechanical treatments in order to control non-native and native invasive species (e.g., kudzu). Currently, there are no known biological controls for specific invasive species on the SNF. Therefore, the potential effects of biological controls cannot be assessed at this time due to the uncertainty of the type of action that could occur.

Herbicides may be utilized to control non-native invasive vegetation. This management action will reduce undesirable plants, which in turn will reduce competition and improve light penetration. The potential also exists for over spray and accidental trampling of individuals during application of herbicides. As a result a range of responses are possible, including damage to stems or leaves (injury), reduced growth and vigor, reduced reproduction (damaged individuals may not produce flowers), and/or mortality (sufficient herbicide penetrates the soil to kill roots). The potential adverse effects of this action should be low when herbicide application is carried out by qualified personnel. In addition, there are significant positive fitness consequences that include improved growth/vigor, increased flower/seed production, improved seedling and juvenile survivorship, and increased population. The benefits of this management activity are anticipated to be significantly greater than any potential adverse impacts.

Manual and mechanical treatments to control non-native invasive vegetation are expected to be the same as effects from the removal of trees and shrubs as described above under Other Vegetation Management.

The following standard and guideline will be implemented to minimize the effects of non-native invasive species management:

1. Where non-native invasive species are invading occupied habitat, utilize control measures necessary to eradicate these undesirable species. In order to avoid negative impacts to Mead's milkweed, treatments should take place between the end of October and the end of March (dormant season).

Minerals Management

Minerals management can be broken into two categories: federal and non-federal minerals management. Approximately 87% of the minerals occurring on the Forest are federally owned minerals. However, within RNA's approximately 47% of the minerals are federally owned. There are many legislative regulations determining the administration of federal minerals. The Bureau of Land Management (BLM) is responsible for the issuance of federal leases, including oil and gas and some industrial minerals such as Tripoli. The Forest Service is responsible for the surface management of these areas. Common-variety minerals, such as limestone, are managed by the Forest.

Mineral exploration is generally a low impact activity with minimal surface disturbance. However, seismic charges may be utilized to test for the presence of certain minerals. Such testing could result in the destruction of some Mead's milkweed plants if it occurs within known sites.

The Natural Areas management prescription area includes a no-surface-occupancy provision. Therefore, it is not anticipated that Mead's milkweed will be adversely impacted by development and extraction of federal mineral resources. Based on the no-surface-occupancy provision for Natural Areas it is not anticipated that minerals management will have any significant negative fitness consequences to Mead's milkweed populations.

Land Ownership Adjustment

The goal of land ownership adjustment is the consolidation of ownership, control access, increase management efficiency, and enhance the protection and management of area values. According to the revised plan, forest lands with federal listed species would only be exchanged with other federal agencies that have management responsibilities for those species. Therefore, no adverse effects are anticipated from land ownership adjustments.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered 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 ESA.

Forest-wide, approximately 13% of the minerals located below Forest lands are non-federal or privately owned. However, in Research Natural Areas the percentage is approximately 53% (USFS 2005b). As such, use of the federal surface will be governed by the legal instrument that identifies the reserved and outstanding rights. For this reason, the Forest Service is limited in any requirements that may be imposed to provide protection to federally listed species. However, these mineral extraction activities, including oil and gas extraction, are regulated through state permitting. As such, impacts

to threatened and endangered species still require consideration in the extraction of mineral resources.

CONCLUSION

The greatest potential threat to the species within the action area is the lack of prescribed fire. Research by Bowles et al. (1998) and Tecic el al. (1998) have provided strong evidence that prescribed fire is essential to successful sexual reproduction and the long term survival of the species. Recent studies by the Missouri Department of Natural Resources involving prescribed fire in some of these areas have supported the findings of Bowles et al. (1998) and Tecic et al. (1998) that *Asclepias meadii* responds well following burning, but soon disappears if fire is not utilized on a regular basis. Without the use of prescribed fire within the area, it is extremely probable that Mead's milkweed will also disappear from the SNF.

The Service (USFWS 2003) has determined that one highly viable population of Mead's milkweed in the Shawnee Hills region is required for recovery of the species. Implementation of the 2006 Forest Plan as proposed would promote the improved population status of Mead's milkweed on the Forest, thus contributing to recovery of the species.

After reviewing the current status of Mead's milkweed, the environmental baseline for the action area, the effects of the proposed 2006 Forest Plan, and the cumulative effects, it is the Service's biological opinion that the 2006 Forest Plan for the SNF, as proposed, is not likely to jeopardize the continued existence of the Mead's milkweed. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. Therefore, no incidental take statement is provided for Mead's milkweed.

Indiana Bat (*Myotis sodalis*)

STATUS OF THE SPECIES

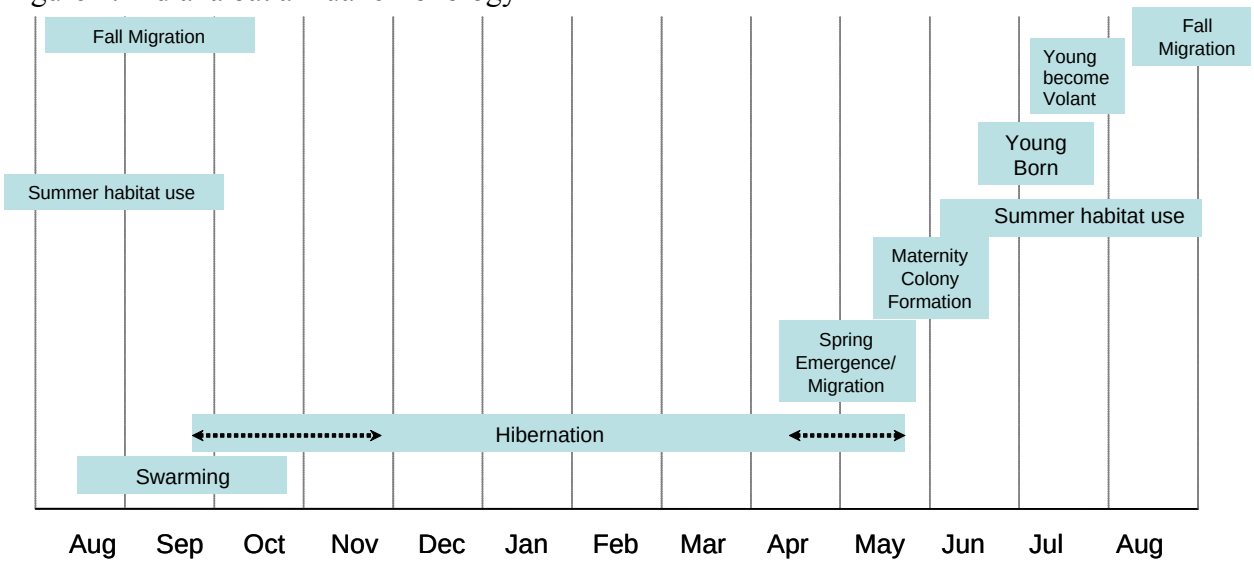
Species Description

The Indiana bat is a medium-sized monotypic species of the genus *Myotis*. It is a migratory species that occurs over much of the eastern half of the United States. Head and body length ranges from 1 5/8 to 1 7/8 inches, and forearm length ranges from 1 3/8 to 1 5/8 inches (USFWS 1983). This species is similar in appearance to both the little brown bat (*M. lucifugus*) and the northern long-eared bat (*M. septentrionalis*) but has several distinct morphological characteristics (Barbour and Davis 1969, Hall 1981).

Life History

There is still much to learn about Indiana bat life history. Figure 2 is a general display of the annual chronology of the Indiana bat. In general, Indiana bats hibernate from October through April (Hall 1962, LaVal and LaVal 1980). Depending on local weather conditions, the hibernation season may be lengthened or shortened (Hicks 2004, Kurta et al. 1997). The non-hibernation season, which includes spring emergence, birth and raising of young, and fall swarming, varies depending on sex and geographical location.

Figure 2. Indiana bat annual chronology



Fall swarming and mating

Indiana bats return to their hibernacula in preparation for mating and hibernation as early as late July (Brack 1983), increasing in numbers through August and peaking in September and early October (Cope and Humphrey 1977). LaVal and Laval (1980) found that the numbers of females appearing at Great Scott Cave, Missouri peaked in late August. Nevertheless, they also captured small numbers of both males and females through the first week of November. Cope and Humphrey (1977) described swarming as a behavior Indiana bats exhibit in which "large numbers of bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in the caves during the day." During this swarming season, which can last for several weeks, bats replenish their fat stores before hibernation. Mating also occurs during the swarming season.

Adult females store sperm throughout the winter and fertilization is delayed until spring emergence (Guthrie 1933). In temperate insectivorous bats, many young females will mate in their first autumn and have offspring the following summer, whereas males are not likely to become sexually mature until the summer after their birth (Gustafson 1975, Schowalter et al. 1979, Racey and Entwistle 2003, Barclay and Harder 2003). Although swarming occurs at the hibernacula, some individuals visit nearby caves to swarm or

mate (LaVal et al. 1976, Cope and Humphrey 1977). Hall (1962) noted that limited mating occurs throughout winter and in late April as bats leave hibernation.

With the exception of the proximity to the hibernacula, swarming habitat is essentially the same as summer habitat (see description below). During fall swarming, Indiana bats roost in standing dead trees and live hickories (Kiser and Elliot 1996). In Kentucky, Kiser and Elliot (1996) found that Indiana bats foraged in upland communities. They postulated that the temperatures within the stream corridors and riparian vegetation during the autumn were too cool, which could impact the activity and density of insects in riparian areas. Insect abundance and activity may be greater in the uplands where temperatures are generally warmer. Roost switching is common during swarming (Kiser and Elliot 1996, MacGregor et al. 1999, Gumbert et al. 2002).

The size of the area needed for swarming is likely correlated with the size of the hibernating colony. Autumn home ranges vary from year to year with proximity and quality of available roosts, weather conditions, and availability of prey (Rommé et al. 2002). Most swarming home range and movement studies are based on male Indiana bat captures. Kiser and Elliot (1996) found the mean foraging area for male Indiana bats (n=14) to be 168 ha (415 acres) in their Kentucky project area and within 2.4 km (1.5 miles) of their hibernaculum. MacGregor et al. (1999) found that the smallest circle that could be drawn to include all roost trees used by an individual bat near its hibernaculum ranged from 0.4 to 568 ha (0.99 to 1,403 acres) and the maximum linear distance traveled was 4.15 km (2.6 miles) with a mean maximum linear distance of 2.08 ± 0.66 km (1.29 ± 0.41 miles). In Rommé et al. (2002), home range estimates include both males and females and varied considerably. A mean home range of 1,584 ± 1,424 ha (3,914 ± 3,518 acres) (90% MCP), and the maximum linear distance traveled from the point of capture was 6.4 km (3.98 miles) and mean maximum of 5.4 ±0.9 km (3.36 ± 0.56 miles).

Hibernation

Indiana bats tend to hibernate in the same cave or mine at which they swarm (LaVal et al. 1976); although swarming has been observed at hibernacula other than those in which the bats hibernated (Cope and Humphrey 1977, Myers 1964). Movements from one cave to another during the same winter have been noted in some Missouri caves (Myers 1964).

Most Indiana bats of both sexes are hibernating by the end of November, although populations of hibernating bats may increase throughout the fall and into early January at some hibernacula (Clawson et al. 1980). In most, larger hibernacula Indiana bats hibernate in large, dense clusters, ranging from 300 bats per square foot to 484 bats per square foot (Clawson et al. 1980, Hicks and Novak 2002).

Indiana bats tend to hibernate in caves with large volume and structural diversity that ensures stable internal temperatures, with little likelihood of freezing (Tuttle and Kennedy 2002). These caves or mines typically have two or more entrances that have a chimney effect air flow. Tuttle and Kennedy (2002) found that populations occupying roosts with midwinter temperatures of 3.0 – 7.2º C increased in number over the past 20

years, but those with temperatures outside of this range decreased in population size. Consistent with these ranges, preliminary data from a study being conducted by Dzurick and Tomasi (2005) suggest that the optimal hibernation temperature is approximately 5ºC.

Spring Emergence and Migration

Female Indiana bats emerge first from hibernation in late March to early April, followed by the males (Hall 1962). Migration is physiologically stressful to Indiana bats, since fat reserves and food supplies are generally low (Humphrey et al. 1977, Tuttle and Stevenson 1977). Consequently mortality may be high following spring emergence. This could be one reason why many male Indiana bats do not migrate far from the hibernacula (Gardner and Cook 2002, Whitaker and Brack 2002). Males that stay nearer to their hibernacula have been recovered moving from 2.5-10 miles (4-16km) in Kentucky, Missouri and Virginia (Hobson and Holland 1995, Rommé et al. 2002). However, other males leave the area completely after spring emergence (Timpone 2004).

Female Indiana bats may stay close to their hibernacula or migrate hundreds of miles from their hibernacula. Migratory distances of over 300 miles have been documented (Gardner and Cook 2002). Shorter distances of approximately 40 miles have been noted as well (Susi von Oettingen, USFWS, pers. comm. 2005 in USFWS 2005).

Summer

Colony formation

Very little information is known about summer male habits. Males have been found roosting individually or in small numbers. They roost in tree snags near their hibernaculum or in areas farther away from the hibernaculum (Whitaker and Brack 2002, Timpone 2004).

Reproductive females begin arriving at their summer habitats as early as mid-April in Illinois (Gardner et al. 1991a/b). LaVal and LaVal (1980) found female Indiana bats emerging from Missouri caves in late March and early April, so it is reasonable to assume that reproductive females are also arriving at their summer habitats in April in some locations. During this period a number of roosts may be used. Females begin to congregate and form colonies as the summer progresses. Indiana bat colonies vary greatly in size and it is difficult to determine exact colony size because colony members may not be using the same roost tree on any given day (Kurta, in press, Timpone 2004, Tim Carter, SIUC, pers. comm. 2005). Most of the Indiana bat colonies documented contained 100 or fewer adult bats (Harvey 2002). Whitaker and Brack (2002) indicated that average maternity colony size in Indiana was approximately 80 adult bats.

Maternity Roosts

Indiana bat maternity roosts have been described as "primary" or "alternate" roosts, depending on the number of bats in a colony consistently occupying the roost tree (Kurta et al. 1996, Kurta et al. 2002, Callahan et al. 1997). Maternity colonies can use up to 10-20 roost trees per year, however Callahan (1993) and Callahan et al. (1997) found that one to three of these roost trees could be classified as "primary" roosts.

Indiana bats primarily roost in standing dead trees with loose bark. Many species of trees are used as roost by Indiana bats. Oaks (*Quercus*), hickory (*Carya*), poplar (*Populus*), elm (*Ulmus*), maple (*Acer*), and ash (*Fraxinus*) are some of the most documented species of roost trees (Gardner et al. 1991a, Kiser and Elliot 1996, Kurta et al. 1996, Kurta et al. 2002, Callahan et al. 1997, Harvey 2002, Kurta and Rice 2002, Whitaker and Brack 2002). Except for pine and hemlock trees used by recently discovered colonies in the southern Appalachian Mountains (Harvey 2002) and on the Mark Twain National Forest in Missouri's Ozarks (USFS 2005a), all known maternity roost trees have been deciduous species. The structural characteristics of the tree, however, appear to be much more important than the species of tree.

Most Indiana bats roost in dead trees with sloughing bark, although a few males and maternity colonies have been documented roosting in bat boxes (Carter 2003), an old church attic (Butchkoski and Hassinger 2002), and in utility poles (Rick Hansen, USFWS, pers. comm. 2005 in USFWS 2005). Habitats surrounding known maternity colony areas vary from riparian, bottomland, and wetland forests (Humphrey et al. 1977, Cope et al. 1978, Kurta et al. 1993, Kurta et al. 2002), to upland forests (Garner and Gardner 1992, Callahan 1993), to agricultural or pasture-like areas (Callahan 1993, Murray and Kurta 2004).

Solar exposure appears extremely important to Indiana bat maternity colonies (Timpone 2004). Increased solar exposure to a roost will increase roost temperature, which in turn minimizes the length of prenatal, natal and juvenile development (Callahan et al. 1997). Roosts with less solar exposure would provide Indiana bats with less than optimal thermoregulatory needs, and could delay parturition. In Missouri, Timpone (2004) found that eight of nine primary roost trees in his study area had less than 15% canopy coverage, and therefore, had high solar exposure. The remaining primary roost had high canopy coverage (85%); however the roosting point was near the top of the bole, affording greater solar exposure. The availability of roosts in a diversity of microclimates is likely to be important for optimal gestation as during periods of extreme hot and dry weather or periods of heavy precipitation, bats may seek secondary roosts that provide a suitable thermal environment.

Night roosts

Indiana bats also use night roosts. Butchkoski and Hassinger (2002) documented Indiana bats night roosting in trees, a bat box, and in their church day roost. Kiser et al. (2002) found Indiana bats night roosting under concrete bridges. Murray and Kurta (2004)

found Indiana bats roosting in trees within their foraging areas. Indiana bats may roost at night for various reasons including resting, aiding in digestion, and energy conservation (Murray and Kurta 2004).

Reproduction

While in their maternity colonies, females give birth to single young generally in June or early July (Humphrey et al. 1977). Most Indiana bats are likely to have single young. Sybill Amelon (USFS, North Central Research Station, pers. comm. 2005 in USFWS 2005) captured a pregnant Indiana bat in Missouri who was carrying two fetuses. Forming maternity colonies reduces thermoregulatory costs, which in turn increases the amount of energy available for birthing and raising young (Barclay and Harder 2003). Studies by Belwood (2002) show asynchronous births that extended over a period of two weeks within one colony (see Timpone 2004 also). Therefore, the size and age of juveniles in the same colony can vary.

Whitaker and Brack (2002) found lactating females from June 10 to July 29 in Indiana, giving us a general idea when lactation occurs. Young Indiana bats become volant (capable of flight) within 3-5 weeks of birth (Cope et al. 1974, Humphrey et al. 1977, Gardner et al. 1991a/b, Kurta and Rice 2002, Whitaker and Brack 2002). Once the young Indiana bats are volant and independent, the maternity colony begins to disperse. The use of primary maternity roost diminishes, although the bats may stay in the maternity roost area prior to migrating back to their respective hibernacula.

Site Fidelity

Data indicate that Indiana bats exhibit site fidelity to their traditional summer maternity and foraging areas (Humphrey et al. 1977, Gardner et al. 1991a/b, Gardner et al 1996, Callahan et al. 1997, Butchkoski and Hassinger 2002, Kurta and Murray 2002). Gumbert et al. (2002) found both roost tree and roost site fidelity. Specific roost trees may be used repeatedly by a colony for several years until the trees are no longer available or suitable; but the colony will continue to use the general area for years. One prevailing belief is that in addition to providing a variety of thermal conditions, Indiana bats may frequently use other roost trees to locate future roost sites for when their existing roosting trees become unsuitable.

Gardner et al. (1991a/b) and Sparks et al. (2004) observed that females returned to their foraging areas between years. A long term study of Indiana bats at the Indianapolis Airport showed these bats foraged in the same general areas from 1997 to 2004 (Sparks et al., in press).

Fall Migration

Indiana bats begin leaving their summer range in early August for their hibernacula (Humphrey et al. 1977, Kurta et al. 1993). Some Indiana bats may stay near their summer ranges into early October (Kurta and Rice 2002). Members of a maternity

colony may not hibernate in the same cave, and may migrate to caves that are over 190 miles (300 km) apart (Kurta and Murray 2002).

Food Habits

Indiana bats feed on flying insects, with few spiders included in the diet. Four orders of insects contribute most to the diet – Coleoptera, Diptera, Lepidoptera, and Trichoptera (Belwood 1979, Brack 1983, Brack and LaVal 1985, Lee 1993, Kiser and Elliot 1996, Kurta and Whitaker 1998, Murray and Kurta 2002). Reports of the Indiana bat's diet vary across the range, as well as seasonally and with age, sex and reproductive condition. Murray and Kurta (2002) postulated that the prey consumed is likely affected by regional and local differences in bat assemblages and/or availability of foraging habitats and prey, making Indiana bats an opportunistic forager.

Foraging Behavior

Indiana bats begin leaving their roosts to forage from 19 minutes after sunset to over an hour after sunset (Viele et al. 2002). Humphrey et al. (1977) found that Indiana bats usually forage and fly within an air space from 6 to 100 ft (2-30m) above ground level. Observations of light-tagged Indiana bats support the contention that Indiana bats do not typically fly close to the ground or water (Brack 1983).

Indiana bats forage in various types of forest, including floodplain, riparian, lowland, and upland forest, closed to semi-open forests, forest edges, (Humphrey et al. 1977, LaVal et al. 1977, Brack 1983, Garner and Gardner 1992, Murray 1999, Butchkoski and Hassinger 2002, Murray and Kurta 2002).

Maintaining or creating sources of water for Indiana bats is important (Krusac and Mighton 2002) in areas lacking water sources. Approximately 20-25% of water used by bats each day comes from drinking (Kurta et al. 1989, Kurta et al. 1990). Indiana bats prey on aquatic insects as well (Murray and Kurta 2002). In Illinois, Carter et al. (2002) found that roosting areas had more patches of water (ponds, lakes, etc.) than random points. Roost sites closer to water reduces travel time to drinking sources, therefore reducing energetic expenditure (Carter et al. 2002).

Status and Distribution

Range wide

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. 668 aa(c)]. Critical habitat was designated for the Indiana bat on September 24, 1976 (41 FR 41914). Eleven 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.).

The Indiana bat is a migratory species found throughout much of the eastern United States. During winter, Indiana bats are restricted to suitable hibernacula primarily located in karst-dominated regions. More than 90 percent of the Indiana bat population hibernates in caves in Indiana, Kentucky, Illinois, New York and Missouri. Smaller hibernating populations are found in Ohio, Michigan, Tennessee, Arkansas, Alabama, Pennsylvania, West Virginia, Virginia, New Jersey, Vermont, and Oklahoma. Until the last four years, the range-wide Indiana bat population had been in decline. Although changes in survey protocols (frequency of surveys, change in personnel) have occurred and we are unable to calculate variance, for the first time in 60 years, the population numbers during the last four years show an increase (see Table 22). Prior to this, Indiana bat winter surveys conducted every 10 years showed a decline in the population. The estimated population in 1960/70 was 883,300 bats; 678,750 bats in 1980; 473,550 bats in 1990; 382,350 in 2000 bats (Clawson 2002). The newer data includes populations in newly discovered hibernacula, as well as population increases or decreases in long known hibernacula.

Table 22. Indiana bat regional and range wide population estimates (compiled by Andy King, USFWS, 2005).

FWS Region	State	2001	2003	2005
R3	Indiana	173,076	183,332	206,609
	Missouri	72,983	66,805	65,104
	Illinois	19,328	35,030	44,336
	Ohio	9,788	9,436	9,769
	Michigan	20	20	20
Region 3 Total:		**275,195**	**294,623**	**325,838**
R4	Kentucky	47,918	41,498	63,339
	Tennessee	10,172	8,900	9,971
	Arkansas	2,476	2,124	2,067
	Alabama	250	317	296
Region 4 Total:		**60,816**	**52,839**	**75,673**
R5	New York	29,642	32,923	41,702
	Pennsylvania	702	853	746
	West Virginia	9,744	9,741	12,677
	Virginia	833	1,090	735
	New Jersey	N/A	644	652
	Vermont	N/A	175	297
Region 5 Total:		**40,921**	**45,426**	**56,809**
Region 2:	Oklahoma	N/A	5	5
Range Wide Total:		**376,932**	**392,893**	**458,325**
		Increase of:	15,961	65,432
		% Increase:	4.2	16.7

Reasons for the range wide population declines from the 1960's and 1970's to recent years and the current increase in range wide populations are largely unknown. In

addition, it is uncertain as to whether recent increases in population numbers can be attributed to true growth, more comprehensive surveys or other factors. However, the cessation of winter cave tours, proper cave gating, and temperature restoration within hibernacula have certainly had a positive effect in many cases (Tuttle and Kennedy 2002).

Threats

Documented Causes of Decline

Disturbance and Vandalism – Human disturbance of hibernating bats has been documented as a serious cause of the decline of Indiana bats especially from the 1960's through the 1980's. Bats generally enter hibernation with sufficient fat reserves to last until spring. When a bat is aroused, stored energy (fat) equivalent to that required for 68 days of hibernation may be used in a single disturbance (Thomas et al. 1990). If arousals happen too often, fat reserves may be exhausted before flying insects return in spring and the bats are able to resume normal foraging.

Direct mortality due to human vandalism has also been documented. In 1960, an estimated 10,000 Indiana bats were killed in Carter Caves State Resort Park, Kentucky, by three youths, who tore masses of bats from the ceiling and trampled and stoned them to death (Mohr 1972). Similar reports have been heard throughout the range of the species.

Disturbance may also occur while Indiana bats are in their summer range. Roost trees containing maternity colonies have been bulldozed or cut down, resulting in direct mortality of adults and juveniles (Cope et al. 1974, Belwood 2002). Mothers can retrieve their young after the roost is down (Belwood 2002), however this type of rescue may not always be possible, especially if the non-volant young are too heavy to carry.

Disturbances may not direct result in mortality but may indirectly affect survival and reproduction by causing the disturbed animals to divert a large proportion of time and energy away from resource acquisition, so that body condition deteriorates and survival and reproductive success are reduced (Hik 1995). Likewise, offspring left unattended due to disturbance may not be directly harmed by disturbances, but mortality resulting from physical factors (e.g., cold temperatures) or facilitation of predation could occur (Frid and Dill 2002). Specific information for Indiana bats roosting during the summer does not present a clear picture of how susceptible the species is to disturbance impacts. In some cases, when bats are disturbed roost abandonment occurs (Callahan 1993) and in other instances the bats return to the same roost (Butchkoski and Hassinger 2002). The disturbance in these studies was associated with research and banding activities. Other studies document Indiana bats roosting near paved roads (Callahan 1993) and a major interstate/airport. However, Gardner et al. (1991a/b) indicated that reproductively active females were rarely less than 500 m from paved highways. More research is needed to determine what type of disturbance near occupied roost trees causes arousal.

Improper Cave Gates and Structures and Removal of Fills – The construction of solid walls or doors in cave entrances (to protect commercial property or non-biological resources), have rendered some hibernacula unavailable to Indiana bats (Humphrey 1978, Currie 2002). These structures change the cave's airflow patterns, often resulting in increased internal temperatures. In hibernating bats, this can cause an increase in the metabolic rate and can prematurely exhaust their fat reserves (Richter et al. 1993, Tuttle and Kennedy 2002).

The removal of cave sediments (fills) can also change the airflow within a cave. Saltpeter mining and the excavation of cave passages to facilitate tours are examples of sediment removals that likely affected Indiana bats (Toomey et al. 2002).

Natural Hazards - Indiana bats are subject to a number of natural hazards. Hall (1962) documented the drowning of a large number of Indiana bats from flooding at Bat Cave, Mammoth Cave National Park and at other hibernacula. Other flooding events have been documented as well.

Bats hibernating in mines are vulnerable to ceiling collapse (Hall 1962, Kath 2002). This is a serious problem at Pilot Knob Mine in Missouri, which once contained the largest known hibernating population of Indiana bats. The mine is now considered too instable to allow winter population censuses to occur (Rick Clawson, MDC, pers. comm. 2005 in USFWS 2005).

Some Indiana bats are subject to freezing during severe winters (Davis 1970, Richter et al. 1993). Indiana bats hibernate near entrances or where cold air is trapped subjecting them to this hazard. Indiana bats in Bat Cave (Shannon County, Missouri) apparently froze to death in the 1950's (R. Myers, U.S. Weather Service (retired), pers. comm. October 1996 as cited in USFWS 1999 and USFWS 2005). The population at the same site was 30,450 in 1985, when the bats were observed roosting on a high ceiling, presumably to escape severe cold at their traditional roosting ledges 7-9 feet above the cave floor. In the subsequent 1987 survey, the population plummeted to 4,150 bats and the floor of the cave was littered with bat bones, suggesting that the bats died during hibernation, most likely from freezing (Rick Clawson, personal observation October 1996 as cited in USFWS 1999 and USFWS 2005).

Indiana bats are vulnerable to the effects of severe weather when roosting under exfoliating bark, in the non-hibernation season. Gardner et al. (1991) documented the displacement of a maternity colony when strong winds and hail stripped the bark from their cottonwood roost. The ephemeral nature of these roosts makes Indiana bats vulnerable to the effects of the trees falling, by wind or age.

Other – Other documented sources of decline include indiscriminate collecting, handling, and banding of hibernating bats by biologists, and intentional flooding of caves by manmade reservoirs (Humphrey 1978, Brack et al. 2003, Myers 1964).

Suspected Causes of Decline

Microclimatic Effects – Tuttle and Kennedy (2002) suggest that when Indiana bat populations are able to roost within a preferred, stable temperature range of 37-45ºF (3-7ºC), they tend to grow. However, when those roosts are outside of this range, the populations tend to decline. This may account for some of the overall population decline.

Land Use Practices/ Ecosystem Changes – The Indiana bats' maternity range has changed dramatically from pre-settlement conditions; forest was fragmented in the upper Midwest, fire was suppressed, and prairie was supplanted with agricultural systems (primarily row crop and pasture/hay field). Native grasses and other plants have been replaced with exotics in large portions of the maternity range, and diverse plant communities have been replaced with simple ones or monocultures. Simplification of the habitat can have profound effects through factors such as availability and abundance of insects on which the bats prey. Conversely, regions surrounding hibernacula in the Ozarks of Missouri and Arkansas (and elsewhere) may be more densely forested than they were historically. Range wide the amount of forested habitat has increased in recent years. However, this habitat is likely less suitable for Indiana bats. For example, fewer old roost trees are present and stands are denser. This results in less favorable roosting and foraging conditions.

Indiana bats are loyal to their summer maternity areas. Projects that remove all or a substantial portion of the trees at a site, such as a large housing development, could destroy all of a colony's primary and alternate roost trees, and may leave the bats with little or no shelter when they return in spring in an energetically stressed condition (Kurta and Rice 2002, Kurta et al. 2002). This may or may not lead to direct mortality, but it could affect reproductive success and recruitment for that year.

Chemical contamination – Pesticides and other chemical contaminants have been implicated in the declines of a number of North American insectivorous bat species (Clark 1981, Clark and Shore 2001). Further studies are needed determine specific effects to Indiana bats.

Previous Incidental Take Authorizations for Indiana Bats Across the Range of the Species

Summary - All previously issued Service biological opinions involving the Indiana bat have been non-jeopardy. These formal consultations have involved: (1) the Forest Service for activities implemented under various different Land and Resource Management Plans on different National Forests in the eastern United States; (2) the Federal Highway Administration for various transportation projects; (3) the U.S. Army Corps of Engineers (Corps) for various water projects; (4) the National Park Service for various projects; and (5) 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 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., standards 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. Additionally, these measures ensured an abundance of suitable Indiana bat habitat on the National Forests and protected all known or new 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 Prescribed Burns and Laxare East and Black Contour Coal Mining Project), none of these biological opinions and associated incidental take statements have exempted or otherwise resulted in the loss of a maternity colony. Required monitoring for three 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 continues 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.

Conclusion - 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, when employed in concert, appear to be effective in minimizing adverse effects on the affected maternity colonies.

ENVIRONMENTAL BASELINE

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area. The environmental baseline is a "snapshot" of a species' health at a specified point in time. It does not include the effects of the action under review in this consultation.

Status of the species within the action area

There is no designated critical habitat for the Indiana bat within the action area. In Illinois, the total population of Indiana bats has fluctuated, but has been increasing since the mid-1980's (Kath 2002). There is one Priority 1 hibernacula on the SNF occurring in an abandoned mine. As shown in Table 23, the number of Indiana bats wintering at this site has grown steadily since 1998. In addition, there are four Priority 2 and several small Priority 3 hibernacula either occurring on or near the action areas. In total, approximately 41,000 Indiana bats currently winter on or near the action area (Kath 2005). This is approximately 9% of the total rangewide population estimate of 458,322 Indiana bats (King 2005).

Table 23. Hibernating Indiana bat populations on or near the Shawnee National Forest (Data from various reports provided by Joe Kath, IDNR).

Year Surveyed	Magazine Mine	Mine #30	Toothless Cave	Ellis Cave	Griffith Cave	Barney Grace	Mine #26
1998	>3,000		1,391		0		
1999	9,074						
2000		495	739	410	0		
2001	14,679	1,500		450-500			
2002				450	0		400
2003	26,325	2,065	413	400-500			
2004				1,557		360	153
2005	33,176	3,624			1,500	519	317

Two documented maternity colonies occur within or near the action area . These colonies occupy bottomland forest habitat on the west side of the SNF at Oakwood Bottoms and Bluff Lake. The colonies are estimated to contain 200-300 and 100-200 adult female Indiana bats, respectively, pre-parturition (Tim Carter, SIUC, pers. comm. 2005). In addition, several summer colonies occur within or near the action area which harbor an estimated 9800 male and non-reproductive female Indiana bats (Kath 2005).

Since 1992, all caves and mines on the Forest with known populations of Indiana bat have been and continue to be monitored for bat numbers and use, as well as temperature, humidity, and human use in cooperation with the IDNR, Unimin Mining and Southern Illinois University.

It is not known how many Indiana bats stay within the Forest boundaries during the non-hibernating season. However, some information about their habitat use and distribution across the Forest has been obtained. Carroll (2001) and Carter (2003) have recently (1999-2001 and 2002) sampled all likely roosting and foraging habitats across the Forest utilizing mist netting as part of a study with the SNF. Their studies have documented a few male Indiana bats in upland, hardwood forest in Alexander County in the vicinity of abandoned mines used as hibernacula. Their studies have also identified the two, relatively large maternity colonies discussed above in Jackson and Union counties on the Forest.

It appears from the studies and surveys for Indiana bats on the Forest since 1992 (Carroll 2001, Carter 2003), including mist net surveys from at least 36 different locations on the Forest, that summer maternity roosting and foraging habitat is confined primarily to bottomland hardwood areas with excessive amounts of mature, hardwood tree mortality that are the indirect result of being heavily affected by past and present prolonged flooding (USFS 2005b). It also appears from these surveys and studies that upland hardwood forests across the SNF at present are not providing high quality or abundant maternity roosting habitat for Indiana bats. Mist net locations on the Forest included many of the best riparian habitats and associated uplands (USFS 2005b).

Additionally, no Indiana bats have been captured in mist net surveys in many, non-native pine plantations on the Forest since 1992 (Carroll 2001, Shawnee National Forest Monitoring Reports 1992-2002). This appears to indicate that non-native pines on the Shawnee National Forest are not high quality habitats or are not used extensively by either male or female Indiana bats as roosting or foraging habitats (USFS 2005b).

Finally, female Indiana bats have been documented utilizing artificial bat houses (improved rocket boxes) in one location in bottomland hardwoods that are known roosting habitat for the species on the Forest (Carter 2003).

Forest Inventory and Assessment (FIA) data provides information that may be useful for estimating numbers of potential roost trees for Indiana bats. FIA is a national inventory system of permanent plots. The figures in the forest inventory data are estimates only.

"A measure of reliability of these figures is given by sampling errors. These sampling errors mean that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the result would have been within the limits indicated (Schmidt et al. 1998)." In Illinois, forest inventories were measured in 1962, 1985, and 1998. There has been a steady increase in the amount of forested land in Illinois since 1960's (Schmidt et al. 1998).

Potential roost trees were estimated by using tree diameter and tree species. In 1998, the SNF had an estimated 6,919,116 potential live roost trees. Live roost trees on the Forest include tree species preferred as roost trees and that are greater than 9 inches in diameter (based upon 1998 FIA inventory information). Potential roost trees include 9-80 inch DBH silver maple, bitternut hickory, shagbark hickory, shagbark hickory, white ash, green ash, eastern cottonwood, white pine, northern red oak, post oak, black locust, sassafras, American elm and slippery elm. These species were identified regionally as suitable roost tree species in USFWS (2001) and locally in Carter (2003) (USFS 2005b).

The SNF land base is about 88% forest cover (251,850 acres) with about 83% uplands and 5% bottomlands. Oak-hickory forest at various successional stages is the dominant community comprising about 67% of the Forest. Beech-maple is less than 1% of the Forest. Another 15% is in pine plantations. Three percent is mixed upland hardwood (mostly tulip poplar) and another 3% is in riparian forests (USFS 2005b).

Approximately 9% of the Forest is presently in openland habitats (barrens, glades, old fields, grassland and brushlands), although only 2-3% (approximately 1,000 acres of wildlife openings, 2700 acres of managed old fields/openlands/grasslands and another 2,700 acres of barrens and glades) would be maintained as openland in the future (USFS 2005b).

Since acquisition of the majority of the Forest in the mid-1930's to late 1950's, when many trees were young saplings or poles, the forest has grown older and denser. Today, approximately 82% of the forest is 50 years old or older. About 31% is over 100 years old. Large, dead or dying hardwood trees are common in 60 year old and older bottomlands and in 80 year old and older uplands. Regenerating forest (age 0 to 9 years) comprises approximately one percent of today's SNF. Another 19% is young forest from 11 to 49 years old (USFS 2005).

Factors affecting the species environment within the action area

Since approval of the 1992 Amended Land and Resources Management Plan, a limited amount of forest management activities has occurred on the SNF. These are listed in Table. 24. This data indicate that active Forest management in the past 13 years has not had a significant impact of Indiana bat habitat in the action area.

Each year, part of the Forest is affected by strong winds, tornados and other natural disturbances. These events leave small to very large areas of dead, down or severely damaged trees and some small amounts of early successional, hardwood forest. These

are generally left to naturally decay. Snags, or standing trees are retained for wildlife purposes except where they pose a hazard to public safety.

Permits are issued for collection of miscellaneous forest products, including predominantly firewood and fence posts. In the last five years, 218 firewood permits were issued, totaling about 872 cords of firewood. All firewood taken from the SNF is downed material. In addition, some permits are given to private landowners to remove dead or leaning trees which are likely to fall on their fences. Given the very small impact area, it is unlikely these activities have significantly impact Indiana bat habitat across the Forest.

Table 24. Management activities that have occurred on the Forest from 1992-2002 (from USFS 2005).

MANAGEMENT ACTIVITY	ACRES/MILES AFFECTED
Timber Harvest --Hardwood Selection Harvest --Pine Shelterwood Harvest --Pine Thinning --Pine/Hardwood Release	 234 acres 11 acres 434 acres 266 acres
Prescribed Fire	10,900 acres
Wildlife Habitat Improvement (Opening and Openland)	2,450 acres
Wildlife Habitat Improvement (Wetland Management)	3,900 acres
Timber Stand Improvement	1,350 acres
Soil and Water Improvement	1,150 acres
Special Uses Issued	1,535 (permits)
Road Construction	0
Road Reconstruction	24 miles
Road Obliteration	20 miles

Non-public lands make up about 65 percent of the land base within the Forest boundary. Land use activities on these lands are determined by the owner. Some land use practices on these properties have benefited Indiana bats, some have had no effect and some have been detrimental.

Firewood cutting and private logging on private land are common practices in southern Illinois. It occurs throughout the year and therefore, it is possible that unknown occupied roost trees are cut. In most instances Indiana bats may escape, but it is likely that a number of Indiana bats, especially non-volant young, are injured or killed. It is impossible to calculate the numbers of Indiana bats that may be impacted by these activities. However, these activities also create canopy gaps and edge effects that likely improved foraging habitat and microclimate conditions in roost trees. This may have had positive benefits for Indiana bats.

Non-energy mineral extraction and coal mining occurs in southern Illinois. These mineral are often extracted via surface mines, resulting in impacts to forested habitats. These activities are permitted by the IDNR, therefore, it is expected that impacts to Indiana bats are minimized to some extent. For example, coal mining permits require that trees be cleared outside the Indiana bat active season. Over the long-term reclamation activities may replace some of the impacted forest. However, this is not assured as often the land is reclaimed back to pasture or agricultural land.

Pesticides are applied to agricultural lands in southern Illinois to control insect infestations. Chemicals may end up in waterways if precautions are not taken and could effect insect populations. In addition, some of these chemicals are persistent and may bioaccumulate in the environment. Therefore, pesticide use may have some significant detrimental impacts on Indiana bats. However, the scope of this impact is unknown.

Summary

Within the action area, three "events" have played a very significant role in the increased numbers of Indiana bats in the area. The first event was the construction of a stabilization structure at the main entrance to Magazine Mine in 2001. According to Kath (2002), "the rapid rate of colonization of the Magazine Mine by Indiana bats may be due to the near-optimal ambient temperatures that occur in this underground complex. Imminent collapse of an entrance to the Magazine Mine resulted in a cooperative effort among industry, government, and nonprofit organizations that resulted in long-term stabilization of the passage." Without this stabilization structure it is likely the mine entrance would have collapsed to such a degree that it would no longer be usable by Indiana bats.

The second and third events are the large scale flooding of the Mississippi River and Big Muddy River in 1993 and 1995. The prolonged flooding resulted in significant amounts of tree mortality, especially in Oakwood Bottoms. This resulted in possibly near optimal conditions for an Indiana bat maternity colony. It is suspected that a small colony that previously utilized riparian habitat in Cedar Creek expanded and began to utilize the habitat created by the floods.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the species and its interrelated and interdependent activities. There are no interrelated or interdependent activities identified at this time. A Forest Plan level consultation requires two levels of analysis. The first level of the analysis will consider how the overall Forest Plan goals and objectives will affect the listed species. The second level of the analysis will consider how the specific management actions that implement the Forest Plan will affect the listed species

There are 10 Indiana bat hibernacula either located within or nearby the action area. Several of these winter hibernacula are also occupied by bachelor males and/or non-

reproductive females during the summer months. In addition, there are two Indiana bat maternity colonies known to be located on the SNF. Male and non-reproductive female Indiana bats likely utilize forested areas of the SNF throughout spring/summer/fall.

Uncertainty

There is much that is unknown about Indiana bat life history. We do not know how or why Indiana bats select the habitats they use (both cave and tree roosts) and why they are not present in other areas that may or may not be similar to where they have been documented. Migration routes and stopover areas are largely unknown. Home range sizes vary greatly across the range of the species. Interspecific and intraspecific competition for resources with other bats is also largely unknown, though limited information exists, at least anecdotally. Threats from pesticides and other chemicals are also uncertain.

Effects of the Implementation of the 2006 Forest Plan Goals and Objectives

As indicated in the Description of the Proposed Action, numerous goals have been established for the 2006 Forest Plan. These goals can be summarized as: 1) to promote ecosystem health and sustainability; and 2) to provide a variety of uses, values, products and services.

Maintaining, enhancing, and/or restoring savannas, woodlands, upland forest and bottomland forest in Management Areas CV, EH, MH, MM, MO, NA, OB, WW and WD will likely create a diversity of habitats suitable for roosting and foraging Indiana bats. Timpone (2004) suggests that Indiana bats may respond positively to habitat enhancement that opens the canopy, increases forest edge and creates (or maintains) snags. Suitable wildlife trees (i.e., snags/cavities) will be maintained for wildlife across the forest. Forest interior management will also provide large blocks of forested habitat available for Indiana bat use. Maintaining small openlands, barrens and glades will provide created and natural openings that Indiana bats may or may not use for foraging, depending on the size of the opening. Maintaining forest or woodland cover across the majority of the Forest ensures that roosting and foraging opportunities will continue to exist across the SNF through the life of the Forest Plan.

Non-native invasive species can reduce the suitability of potential roosts and can reduce the availability of prey for Indiana bats. Kudzu and honeysuckle vines cover dead trees making them unsuitable for Indiana bat roost habitat (Kurta 2004, Kurta and Rice 2002). Fescue, multiflora rose, garlic mustard and other non-native species simplify ecological systems, potentially reducing plant hosts for terrestrial insects eaten by Indiana bats. Implementation of integrated pest management practices and control of non-native invasive species in areas utilized by Indiana bats may increase long-term habitat availability. In the short-term habitat quality may increase or decrease depending upon the methods utilized.

Soil productivity, water quality and the integrity of riparian ecosystems and water-supply watersheds will be maintained and/or enhanced through non-point water pollution control methods. Development of management prescription area WW will protect the integrity of major water supply watershed located on the Forest. Implementation of forest-wide standards and guidelines for riparian corridors (filter-strips) will ensure long-term protection of water quality in these important habitats across the Forest. This will benefit Indiana bats by providing clean water for drinking and healthy aquatic systems that produce aquatic prey items.

Many of the goals of the Forest Plan provide for meeting multiple use objectives. Management prescription areas include DR, HR, LO, NM and RA which address recreation, protection of historically significant sites, large openland management and research areas. These management areas make up less than 9% of the Forest. The forested habitat located in these areas will be available for Indiana bat roosting and foraging.

Standards and guidelines for Indiana bats will be implemented throughout the Forest to ensure protection of roosting and foraging habitat for this species. Specific measures have been developed to protect known maternity colonies and hibernacula, including the foraging habitat around these important sites. Caves/mines utilized as hibernacula will continue to be managed to protect bats from disturbance during hibernation and to improve hibernacula conditions.

The overall goals and objectives of the 2006 Forest Plan for the SNF are consistent with the habitat needs of the Indiana bat. Suitable foraging and roosting opportunities will be maintained and/or improved across the SNF with the implementation of this plan.

Effects of Implementation of the Types of Management Proposed to Accomplish Forest Plan Goals and Objectives

Although we anticipate that the goals of the 2006 Forest Plan will benefit Indiana bats overall, there will be direct and indirect effects to the Indiana bat that could occur with the implementation of the 2006 Forest Plan.

Our analysis assesses the likelihood and magnitude of impacts that may result directly or indirectly from the proposed management actions. 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 likelihood of the exposure and the consequent response occurring. Specifically, we focus on the impacts to individual fitness (e.g., effects on individual annual and life-time survival rates and annual and life-time reproductive potential). Once we anticipate the individual fitness consequences, we then look at how these individual responses affect 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 will affect the fitness of the species rangewide.

At the program-level, definitive temporal and spatial information for the specific management actions is lacking, thus, our analyses are necessarily broad. We, therefore, identify both the range of possible fitness responses and the most likely fitness responses anticipated for each management activity. As described below, many of the standards and guidelines significantly reduce the potential exposure for Indiana bats, thereby effectively neutralizing most potential negative responses. However, some potential negative responses remain. Our analysis relies on both Indiana bat specific and the general bat literature to make these predictions.

Timber Harvest/Management

In implementing the 2006 Forest Plan, approximately 1,051 acres per year during the first 10 years would be harvested for forest management or wildlife habitat improvement purposes. This number increases to approximately 1,932 acres per year during the second decade of implementation. This equates to less than 0.4% and 0.7% per year, respectively, of the Forest being affected by timber harvest during the next 20 years. In total approximately 9% of the Forest will be impacted by timber harvest activities during the next 20 years. The normal operating season for timber harvest is April 1 to November 30 for uplands and May 1 to September 30 for bottomlands. Shelterwood and shelterwood with reserves are the primary harvest methods proposed. A detailed explanation of silvicultural methods is provided in Appendix D of the Proposed Plan (USFS 2005c).

Activities associated with timber harvest have direct effects to Indiana bats. This includes temporary road, skid trails/landing construction and logging. Undetected and occupied suitable roost trees may be cut during the spring, summer and fall. Direct mortality or injury to Indiana bats could occur if a maternity tree is cut and pups are non-volant. Individual roosting Indiana bats could be killed. Roosting areas could be abandoned. At a minimum roosting activities would be disrupted and bats would have to relocate to another roost tree, requiring additional energy expenditures. The range of response for Indiana bats would range from displacement to mortality.

Logging may create large openings that are unsuitable for foraging. This could result in Indiana bats having to find additional foraging areas and travel corridors. This could result in avoidance of some areas, extra energy expenditures and reduced feeding success. In addition, the noise and vibration associated with cutting non-roost trees may startle or displace nearby roosting Indiana bats.

However, timber harvest may also create conditions that provide benefits to Indiana bats. In situations where roads and/or skid trails are constructed but maintain a canopy foraging conditions may be improved by reducing clutter. Roosting habitat may also be improved by reducing clutter around roost trees. The edges of log landings may provide roost trees with improved solar exposure, thus improving microclimate/thermal conditions. This may improve reproductive success and fitness leading to population stability or increase.

Logging may create future roost trees on the edge of clearings. Such trees would have improved microclimate conditions. In cases of maternity trees this may shorten gestation periods leading to population stability or increase. Shelterwood and shelterwood with reserves harvest will result in an open understory, but maintain suitable canopy cover. This will improve foraging conditions by reducing clutter and improve roosting habitat by reducing clutter around roost trees. This could result in increased fitness and shorter gestation periods leading to population stability or increase. Finally, reclamation of temporary roads following timber harvest will restore forested habitat potentially creating new roost trees in the future.

The potential adverse fitness consequences associated with timber harvest are greatly ameliorated through implementation of standards and guidelines for Indiana bats. The following is a list of Indiana bat standards and guidelines (in italics) applicable to timber harvest/management and an explanation of benefits:

1. *Known maternity roosting habitats (within SNF) include bottomland hardwoods, shrub-swamps and riparian forests. In known maternity roosting habitat, 50 percent to 75 percent of the basal area of live trees should be greater than eleven inches diameter at breast height where possible. This would not be possible on every acre. In order to provide for retention, recruitment and mortality in hardwood forests, it would only apply to an entire maternity roost habitat area such as the entire Oakwood Bottoms Greentree Reservoir. Management will include a preponderance of species that exhibit exfoliating bark characteristics. Typical species include American elm (Ulmus americana), slippery elm (Ulmus rubra), eastern cottonwood (Populus deltoides), bitternut hickory (Carya cordiformis), shellbark hickory (Carya laciniosa), shagbark hickory (Carya ovata) and species in the red oak group (Quercus spp.). Known roosting habitats should contain an abundance of canopy gaps. Crown-closure (of live trees greater than eleven inches in diameter at breast height of all species) should be between 30 percent and 80 percent, where possible (i.e., this is not possible in shrub-swamps).*

This standard will ensure an appropriate number and mix of tree species suitable for Indiana bat roosting will be maintained in maternity roosting habitats. In addition, suitable crown-closure and canopy gaps will be maintained to provide suitable foraging conditions. That is, the character in terms of Indiana bat habitat will be maintained through the implementation of this standard and guideline. Thus, although exposed individuals may respond to the change in habitat (i.e., locate a new roosting tree, alter foraging areas, etc.), we fully expect that an individual's or colony roosting and foraging area will not be substantially altered and should not need to abandon their traditional home-range. Further, given the forested landscape and the standard and guideline, if individuals need to move outside their traditional home-range we expect these individuals to readily find suitable habitat nearby.

2. *Within 5 miles of known roosts or hibernacula, known roost trees will not be cut down or removed through harvesting. Management of forests should include*

maintaining a diversity of age, size and species classes of potential roost trees. It should also include the maintenance of existing forested landscapes, snag and live tree retention, riparian corridors and hibernacula protection and improvement projects. When removal of dead trees or trees with exfoliating bark is needed for safety or to accomplish project objectives during 4/1 – 11/15, they will be evaluated (including exit surveys if needed) for bat usage prior to removal. Potential roost tees cannot be removed during these periods unless they are evaluated (biological evaluation done by biologists) and/or surveyed to document non-use by roosting bats. Surveys could include mist netting of sale areas, exit surveys for individual trees or other surveys approved by the U.S. Fish and Wildlife Service.

This standard applies to winter hibernacula and summer colony caves/mines. Implementation of this standard should substantially reduce the possibility of direct mortality of male or non-reproductive female Indiana bats through loss of unknown occupied roost trees. However, the possible loss of small numbers of unknown occupied roost trees may still occur as potential roost trees are removed for human safety or to accomplish project objectives. We anticipate that only roost trees occupied by single or a few roosting bats are likely to go undetected. Thus, we anticipate one to a few bats could be injured or killed if occupying a tree that is cut. In addition, we expect that only a subset of these individuals exposed to this threat will be injured or killed as we anticipate during cutting operations, most bats will be aroused and will escape before the tree is felled. Although disturbance from the timber harvesting will result in a response by all exposed individuals (e.g., startle, alarm, abandon roosts), we do not expect a negative fitness consequence to occur. By managing the forest for a diversity of age and size classes and species, suitable roosting habitat should be provided over the long-term.

3. *Greater than 5 miles from known hibernacula and maternity roost areas, potential roost trees that include live hardwood trees with exfoliating bark would not be removed from 4/1 – 9/30 unless necessary for human safety or to accomplish project objectives. Removal of these trees during the above roosting period requires evaluation and/or surveys to determine non-use by roosting bats. Surveys could include mist-netting of sale areas, exit surveys for individual trees or other surveys approved by the U.S. Fish and Wildlife Service.*

This standard will be applied outside of the 5 mile radius of maternity colonies and hibernacula. Implementation of this standard should substantially reduce the possibility of direct mortality of Indiana bats through loss of undetected occupied roost trees. As indicated above, a loss of small numbers of unknown occupied roost trees may still occur as potential roost trees are removed for human safety or to accomplish project objectives. Again, we expect only a few individuals will be injured or killed as a result. By managing the forest for a diversity of age and size classes and species, suitable roosting habitat should be provided over the long-term.

4. *In all project areas across the Forest where large overstory, hardwood trees will be cut, mist-netting surveys, exit surveys or other surveys approved by the U.S.*

Fish and Wildlife Service would be done prior to harvest or cutting to identify known roosting habitats. Mature leave trees in areas where the shelterwood and shelterwood with reserves harvest methods are applied (including throughout the uplands) will include mixtures of the following tree species preferred by Indiana bats for roosting where they exist: silver maple (Acer saccharinum), bitternut hickory (Carya cordiformis), shellbark hickory (Carya laciniosa), shagbark hickory (Carya ovata), white ash (Fraxinus americana), green ash (Fraxinus pennsylvanica), eastern cottonwood (Populus deltoides), white oak (Quercus alba), northern red oak (Quercus rubra), post oak (Quercus stallata), black locust (Robinia pseudoacacia), American elm (Ulmus americana), and slippery elm (Ulmus rubra).

This standard is a general standard to be applied in forested habitat throughout the SNF. Implementation of this standard should ensure a long term supply of potentially suitable roosting habitat for Indiana bats within the SNF. In addition, crown-closure suitable for Indiana bat foraging should be maintained over the long-term.

5. *Retain all standing dead trees unless necessary to cut for human safety or to accomplish project objectives. Dead trees that are potential roost trees cannot be removed from 4/1-9/30 greater than 5 miles from known hibernacula or maternity roosting habitats and from 4/1-11/15 less than or equal to 5 miles from known hibernacula or maternity roosting habitats unless they are evaluated (biological evaluation by biologists) and/or surveyed to document non-use by roosting bats.*

This standard is a general standard to be applied in forested habitat throughout the SNF. Implementation of this standard will ensure a supply of potentially suitable roosting habitat for Indiana bats in the short term. Removing standing dead trees outside the active season for Indiana bats or conducting evaluations will reduce the possibility of occupied roost trees being removed. As discussed in the Life History section, loss of a primary or a high quality secondary roost tree can have reproductive consequences even if cut during the inactive season. We believe, however, the standards and guidelines ensure that the character of all known maternity areas will not be degraded. That is, suitable roosting and foraging habitats will be retained in these areas. Thus, we do not anticipate any indirect adverse fitness consequences from loss of roost trees in winter.

6. *Retain a forested corridor between caves or abandoned mine entrances that are being utilized by bats and foraging areas (stream or reservoir).*

This standard should ensure travel corridors are maintained between hibernacula and bat foraging habitats.

In summary, the above standards and guidelines ensure the character of occupied Indiana bat sites is maintained. As such, we do not anticipate any negative fitness consequences for Indiana bats when roost and foraging habitats are affected by timber harvest activities. We anticipate direct negative effects (injury or mortality) from timber harvesting when undetected occupied roost trees are cut. We expect only roost trees harboring a single or

few bats are likely to go undetected, and only a subset of the individuals in these trees will actually be injured or killed.

Timber Stand Improvement

An additional 536 acres per year will be affected by timber stand improvement during the first 10 years. This increases to approximately 1,266 acres per year in the second decade. Timber stand improvement may include cutting and/or girdling small numbers of trees to open the forest canopy, as well as stump treatments with herbicides. The potential impacts associated with cutting trees for timber stand improvement are similar to those discussed above for timber harvest. However, the scale of potential impacts is smaller as the number/acres of trees impacted are reduced. As indicated with the above standards and guidelines applied to Indiana bat roosting habitat, known roost trees will not be cut down or removed. With implementation of the standards and guidelines, impacts to Indiana bats are greatly ameliorated but not eliminated. Small numbers of unknown roost trees occupied by a single or few bats may be removed for human safety or to accomplish project objectives.

Stump treatments for herbicides may result in minor, localized impacts to insect populations. Persistent chemicals that bioaccumulate in the food chain are not proposed to be utilized. In addition, the following forest-wide guideline will be applied:

1. *FW 21.1 (G) Pesticides and Biological Treatment – The use of pesticides and biological treatments is allowed following appropriate environmental consideration that indicates use will meet management objectives. Protective measures will be implemented where needed wherever aquatic pesticides would be used and near stream courses wherever terrestrial pesticides would be used.*

With implementation of this guideline and best management practices it is not anticipated that stump treatment with herbicides will have any measurable impact on insect populations or on Indiana bats.

Fire Management

Approximately 11,359 acres per year (excluding openlands) could be prescribed burned during the first 10 years. This increases to approximately 12,306 acres per year (excluding openlands) in the second decade. This equates to approximately 4% and 4.3% of the forest, respectively, that could be burned annually. Landscape scale prescribed burns and site preparation/brush disposal burns are proposed to accomplish oak and other vegetation regeneration, reduce hazardous fuels, wildlife habitat management, ecological restoration and maintenance of fire-dependent plant communities.

A normal operating season for prescribed burns has not been indicated, however, according to the DEIS for the Forest Plan (USFS 2005d), prescribed burns will typically occur in the fall and spring. Appendix E of the Proposed Plan indicates an open-ended burning season within Natural Areas to allow for growing season burns during the height

of a drought cycle. Prescribed fire can be broken into various components. This includes fireline construction, ignition and burn, and mop-up operations.

Where possible, natural features such as, streams and drainage ways, roads and trails, will be used as fire-breaks. However, in some cases firelines will have to be constructed. In general, firelines are constructed by raking 3-foot wide swaths through the Forest. Machinery is used in some situations and usually no big trees are cleared. Small numbers of unknown and occupied roost trees may be cut during all seasons with most during the spring, summer and fall to construct firelines. Direct mortality or injury to Indiana bats could occur if a maternity tree is cut and pups are non-volant. Individual roosting Indiana bats could be killed. Roosting areas could be abandoned. At a minimum roosting activities would be disrupted and bats would have to relocate to another roost tree, requiring additional energy expenditures. If roost trees are cut during winter extra energy would be required in the spring to find new roost trees. Roost quality may decrease leading to an increased gestation period. The range of response for Indiana bats would range from displacement to mortality, leading to decreased reproduction.

The potential impacts associated with fireline construction are greatly ameliorated by the standards and guidelines developed to protect Indiana bat roosting habitat. First, for the reasons identified under Timber Harvest, we do not anticipate any negative fitness consequences from traditional roost trees being cut during the inactive season. Also, given the small amount of habitat impacted by fireline construction, we do not expect a substantial portion of the bat's home-range to be affected by fire-line construction. Second, we do not anticipate that an occupied primary or secondary roost tree would go undetected, and hence, cut during the active season. With implementation of Indiana bat standards and guidelines we also do not anticipate that undetected occupied roost trees will be cut due to fire line construction. These standards and guidelines would require that all potentially suitable roost trees be checked for Indiana bat use prior to removal. Any trees identified as Indiana bat roosting trees can be avoided during fireline construction.

Ignition will generally occur with the use of drip torches. However, in some situations aerial ignitions will be accomplished with the release of a poly (plastic) material ping pong balls that are normally completely consumed by the chemical reaction that causes ignition. Ignition and burns may result in the loss of potential roost trees or unknown occupied roost trees in the spring, summer or fall. This may result in direct mortality or injury if maternity trees are impacted and pups are non-volant. Colonies may abandon the area which would require relocating to another primary roost tree within the home range. Single roosting bats may also be impacted. At a minimum roosting activity would be disrupted requiring additional energy expenditures. Indiana bats may be displaced or actually killed by the proposed action. Prescribed fire conducted during the winter may result in the loss of primary and/or secondary maternity roost trees. Indiana bats would be required to expend extra energy finding new roost trees in the spring. Roosts may be of decreased quality which could lead to an increased gestation period. This may lead to displacement, lower pup fitness, lower over-winter survival, and ultimately decreased reproduction. However, as explained below, the standards and guidelines specific to

prescribed burns will make it unlikely that maternity colonies will have direct or indirect negative fitness consequences. It is anticipated that males and non-reproductive female Indiana bats may flush from roosting trees during prescribed fire. However, these individuals are highly mobile and should suffer only short term effects as a result. Therefore, the standards and guidelines specific to prescribed burns will make it unlikely that males and non-reproductive females will have direct or indirect negative fitness consequences.

The smoke from prescribed fires may or may not cause Indiana bats to flush from the roost, depending on the location on the tree where bats are actually roosting and on whether or not that area becomes super-heated or is exposed to too much smoke. Since prescribed fires generally move through an area fairly quickly (generally less than 24 hours for an entire burn unit (USFS 2005a in USFWS 2005)), this flushing is not likely to significantly alter the habits of Indiana bats, though it may expose them to a slight predation risk. Indiana bats have been documented switching roosts during the day (Kurta et al. 2002) also suggesting that this flushing may not be a significant risk. Carter et al. (2002) suggests that the ability to arouse quickly in summer, and the ability to carry young in flight, combined with the behavior of using multiple roosts, could offset negative impacts of snag roosts being destroyed by fire. Furthermore, as indicated below, the standards and guidelines make it unlikely for non-volant pups to be directly exposed to smoke.

Prescribed burns may result in temporary decreases in insect abundance. The potential adverse impacts to Indiana bats would depend upon the time of year when the burns occur and the location. Prescribed burns conducted in the spring or summer within the home range of maternity colonies may significantly depress insect production. On the other hand prescribed burns within maternity colony home ranges during the fall are not expected to be as significant as Indiana bats move out of these areas in transit to hibernacula.

However, within the area around hibernacula, burning during the spring would allow the opportunity for vegetative growth and subsequent insect production in the fall. Fall burns within the areas around hibernacula could significantly depress insect populations during the swarming period. This would impair the bats ability to accumulate fat reserves, thus impacting overwinter survival and reproductive success the following year. As explained below, however, the standards and guidelines greatly reduce the potential for burns to occur in maternity colonies during the spring and summer, and hence, their prey availability should not be affected. Also, the standards and guidelines reduce the potential for prey abundance in the spring and fall around known hibernacula to be adversely affected by burns.

Some prescribed fire is anticipated during the winter. However, most fires would be conducted during the late fall or early spring when Indiana bats are in hibernation. Prescribed fire near hibernacula could result in smoke entering and killing bats while in torpor. Prescribe fire conducted near hibernacula in the summer may also impact

summer colonies. For reasons discussed below, we do not believe either of these scenarios are likely to occur, however.

The potential adverse effects associated with prescribed fire are greatly ameliorated through implementation of standards and guidelines for Indiana bats. The following is a list of forest-wide and Indiana bat standards and guidelines applicable to prescribed fire and an explanation of benefits for Indiana bats:

1. *Prohibit any significant disturbance such as prescribed burning and smoke generation and tree cutting, except for bat habitat enhancements, within approximately 100 feet of a cave entrance or open abandoned mine entrance when occupied by bats.*

2. *FW51.2.1.1 (S) Smoke-management planning is used to control the effects of smoke emissions and meet air-quality standards. During prescribed fires, consideration shall be given to smoke-sensitive areas including Indiana or gray bat hibernacula that may lie downwind of the burn.*

3. *FW51.2.1.2 (S) Burns within 0.25 miles of any Indiana or gray bat hibernacula shall be conducted under conditions that will reduce or eliminate smoke dispersing into the hibernacula.*

Implementation of these standards will significantly reduce the possibility of smoke entering hibernacula and impacting hibernating or roosting Indiana bats.

4. *FW51.2.1.3 (S) To reduce the chances of affecting maternity roosts and foraging habitats, no prescribed burns shall be done in upland forest from 5/1-9/1 and in bottomland forests from 4/1-9/1. No burning shall be done in forested areas of Oakwood Bottoms during the spring seasons, 3/1-4/1 annually. Only 30% (approximately 1,900 acres) of the Big Muddy bottomlands (approximately 6,200 acres of National Forest) east of the Big Muddy levee shall be burned (blackened) annually during spring burning seasons.*

Implementation of this standard will significantly reduce the potential impacts associated with prescribed burns within the home range of maternity colonies. By limiting the timing and amount of prescribed burning within the Oakwood Bottoms and Big Muddy bottomlands, insect populations should not be significantly affected in any given year to such a degree that there will be negative fitness consequences for Indiana bats.. As prescribed burns will occur in the spring in uplands, roosting Indiana bats roosting could be adversely impacted. However, these burns will occur early in the maternity season prior to the birth of pups, thus female bats should be able to relocate to other roosting habitats, thus direct mortality is not anticipated. Fall burns after 9/1 may also adversely impact roosting Indiana bats. However, by this time pups will be mobile and should be able to relocate to other roosting habitats, thus direct mortality is not anticipated.

5. *FW51.2.1.4 (S) To reduce the chances of adversely affecting Indiana bat, male roosting habitat within 4km (2.5 miles) of surrounding known hibernacula, no more than 20% of the habitat in this zone shall be burned (blackened) annually. Within 4km-8km (2.5 to 5 miles) surrounding known hibernacula, no more than 50% shall be burned (blackened) annually.*

Implementation of this standard should ensure that insect populations are not significantly depressed around hibernacula in any given year due to prescribed burns. Thus, the fitness of individuals using these areas should not be negatively affected (i.e., insect availability is not expected to be decreased such that the foraging efficiency of those individuals will be decreased). Some burns will occur during the spring and summer which may impact roosting habitat for individuals using this area in the summer. However, these bats are mobile and will be able to locate alternate roost trees readily. Given the small amount of habitat impacted around hibernacula (see analysis in FEIS Appendix F and Appendix B of this biological opinion) and the relatively small number of individuals exposed, the bats are expected to be able to relocate and fitness consequences are not anticipated. In the fall, larger numbers of Indiana bats occupy the habitat within and surrounding hibernacula. During this time bats are accumulating fat reserves and continue to roost in trees to some extent. Habitat around hibernacula is abundant in comparison to the number of bats utilizing these hibernacula (Appendix B).

Prescribed fire may also benefit Indiana bats in many ways. High intensity fire may create additional snags and potential roost trees for Indiana bats. Opening the understory would reduce clutter around these potential roost trees improving microclimate diversity and foraging conditions. In addition, oak regeneration should occur in response to the fire, leading to long-term potential roosting habitat on the landscape. The benefits would be increased fitness, shortened gestation periods and improved reproductive success. This could ultimately lead to population stability or increase.

Finally, for some time following prescribed fire, ranging from months to years, insect abundance in the area increases (Jackson 2004). While this effect may depend on location and/or time of year, it may lead to higher quality and quantity of the insect base and increased feeding success for Indiana bats. This would lead to an improved energy budget, increased reproductive success and survival, ultimately resulting in population stability or increase.

Mop-up operations include measures to extinguish burning coals and/or trees to preclude fire escape. Burning trees may be felled for this purpose. No additional impacts beyond those discussed above are anticipated as a result of mop-up operations.

The SNF must also respond to wildland fires using various suppression techniques. Specific suppression techniques have not been identified in the Forest Plan. The forest-wide standard and guideline for wildfire states the following:

1. *FW51.1 (S) Wildfire - Wildfire should be suppressed as necessary, utilizing the full range of suppression strategies applicable to the area in which the fire is burning, in order to protect lives and property, national forest lands and other*

ownerships. A fire-management plan shall be maintained based on direction in the "Fire Management Analysis and Planning Handbook" and manual direction. Wildlife prevention, detection and suppression, and hazardous-fuels reduction are planned based on this direction. Agreements for fire detection and suppression on Forest lands by cooperating firefighting agencies must define suppression-action commensurate with established resource-management prescriptions and fire-plans. All contracts for work should contain clauses or direction that provide for adequate fire protection on or near the work-site.

There is no way to know when and where wildland fires will occur and what their severity will be, therefore effects are unquantifiable at this time. Many of the effects, however, are anticipated to be similar to those for prescribed fire. However, there may be additional effects associated with specific suppression techniques or measures. The impacts, if any, associated with suppression will be evaluated individually after the emergency situation is addressed.

Integrated Pest Management/Non-Native Invasive Species Control

Integrated pest management may include a mix of both pesticide and mechanical treatments. Herbicides will be utilized to control non-native invasive vegetation such as kudzu and garlic mustard. Such herbicides can have localized impacts to insect populations, particularly if they enter waterways. Household pesticides will be used for the maintenance and protection of health and safety at buildings, recreation sites, administrative sites and other facilities. Although insect populations in these areas will be impacted, this is not anticipated to adversely impact Indiana bat as they are not known to forage in these areas. Persistent chemicals that bioaccumlate are not proposed to be utilized on the Forest.

Localized decreases in insect abundance may reduce Indiana bat foraging and feeding success. In some instances bats may be required to travel further to obtain food. This would disrupt the bats energy budget. As explained in the Life History section, depending on the time of year and environmental conditions, significant imbalances in their energy budgets can lead to decreased reproductive success for adults and decreased health for pups.

In addition to the use of pesticides, mechanical treatments may be utilized to control non-native species. This may include the use of equipment to clear small pockets of vegetation. This will impact a minor component of the forest habitat on the Forest and is not anticipated to result in adverse impacts. Opening up the understory by clearing small pockets of vegetation would benefit Indiana bats by improving foraging conditions and reducing clutter around roost trees. However, significant positive benefits are also not anticipated due to the small amount of forested habitat that would be affected.

With implementation of the following forest-wide standards and guidelines, potential impacts to Indiana bats as a result of integrated pest management and non-native invasive species control are anticipated to be minimal or non-existent:

2. *FW21.1 (G) Pesticides and Biological Treatments – The use of pesticides and biological treatments is allowed following appropriate environmental consideration that indicates use will meet management objectives. Protective measures will be implemented where needed wherever aquatic pesticides would be used and near stream courses wherever terrestrial pesticides would be used.*

This measure will enable the development of site-specific protective measures appropriate to the specific chemical proposed. These measures should significantly minimize any impacts to local insect populations, thereby reducing the extent of impact to Indiana bats.

3. *FW 34.2.2 (G) – The risk of damage from existing non-native invasive species should be reduced through integrated pest management. Invasion-prevention measures should be implemented to maintain native ecosystems. Existing population of non-native invasive species should be eradicated, controlled and/or reduced. Effects of management activities on the invasion and spread of non-native invasive species should be considered and mitigated, if needed. Natural areas and lands adjacent to natural areas have the highest priority for the prevention and control of non-native invasive species.*

Implementing measures to prevent invasion of and to control/eradicate non-native invasive species will protect the hardwood ecosystem upon which Indiana bats depend.

Wetland Management

Wetland management activities may involve levee/berm construction or other methods to restore hydrology (e.g., excavation). This activity is most likely to occur in the OB and MO management areas. The potential effects of the loss of these roost trees are similar to the effects discussed above under timber harvest although on a much smaller scale. The Indiana bat standards and guidelines discussed under Timber Harvest are applicable here and will minimize any potential impact associated with levee/berm construction. However, as construction is most likely to occur during the summer, the possibility of losing roost trees undetected, but occupied by Indiana bats is possible. Again, we expect only lesser quality roost trees to go undetected, and thus, only single or a few roosting bats are likely to be exposed to this stressor.

Restoration/creation of wetland habitats creates conditions favorable for the production of aquatic insects. Increased insect abundance in the OB management area will benefit Indiana bats by increasing feeding success, thus improving their energy budget. This could ultimately lead to increased reproduction and/or survival and population stability or increase.

Pond/Waterhole Creation and Management

The creation and management of ponds and waterholes will generally be beneficial for Indiana bats. Localized increases in aquatic insect abundance should occur which would increase feeding success and provide higher quality food resources. This will improve the energy budget and may ultimately lead to increased reproduction and/or survival and population stability or increase.

The aquatic pesticide rotenone may be utilized to control rough or invasive fish. The persistence of this chemical is temperature dependent and is anticipated to last only a few days. Application of this chemical may result in very localized, temporary impacts to insect populations. This could lead to reduced foraging/feeding success and having to travel further to obtain food. This would disrupt the energy budget. Given the localized and temporary nature of these impacts, it is unlikely that Indiana bats will experience any negative fitness consequences.

Minerals Management

The demand for minerals fluctuates and is difficult to predict. Many factors such as price, economic feasibility of extraction, technological advances and supply can determine demand. Approximately 87% of the minerals occurring on the Forest are federally owned minerals. There are many legislative regulations determining the administration of Federal minerals. The Bureau of Land Management (BLM) is responsible for the issuance of Federal leases, including oil and gas and some industrial minerals such as Tripoli. The Forest Service remains responsible for the surface management of these areas. Common-variety minerals, such as limestone, are managed by the Forest.

Mineral exploration is generally a low impact activity with minimal surface disturbance. However, seismic charges may be utilized to test for the presence of certain minerals. Such testing could disturb hibernating Indiana bats if it occurs near hibernacula. This disturbance could result in fat reserves being lost at a critical time, potentially leading to death of individuals or reduced reproductive success.

Development and extraction of minerals potentially involves several activities including temporary road construction, extraction and reclamation. Temporary road construction could result in the loss of roost trees (primary/secondary) in the winter or the cutting of undetected suitable roost trees in the spring, summer or fall. The impacts to Indiana bats associated with the loss of roost trees are similar to those discussed above for timber harvest. Temporary roads could also create travel corridors in situations where a canopy is maintained. This could benefit Indiana bats by improving foraging conditions, leading to increased fitness, shorter gestation periods and potentially population stability or increase.

Extraction of minerals could also result in the permanent loss of roosting and foraging habitat. This would lead to displacement of Indiana bats and potentially reduced reproduction. The creation of large openings would create conditions unsuitable for Indiana bat foraging. This would require having to find new travel corridors and foraging areas. Indiana bats could respond by avoiding areas or having reduced feeding success.

Spills or discharges from oil pads could enter waterways and impact water quality and insect prey. Streams and wetlands could be altered or lost as a result of landscape changes. These physical changes could result in reduced feeding success, increased travel distance to food/water resources and reduced drinking water sources. This ultimately could result in displacement of individuals or reduced reproduction.

However, some activities may create small canopy gaps which create open edge habitats. This may provide roost trees with improved solar exposure leading to improved thermal conditions. This may improve reproductive success and fecundity leading to population stability or increase.

Federal leases contain standard stipulations. One of these stipulations involves the protection of federally listed threatened and endangered species. The stipulation specifies the following:

> *All or part of the leased lands may contain animal or plant species classified under the Endangered Species Act of 1973, as amended. Other species may have been identified as sensitive in accordance with Forest Service Manual 2670 and be listed on the current Regional Forester's list of sensitive plant and animal species. Further information concerning the classification of these species may be obtained from the authorized Forest officer.*
>
> *Exploration and development proposals may be limited or modifications required if activity is planned within the boundaries of a threatened, endangered or sensitive plant or animal species location as it then exists. All activities within these areas must be conducted in accordance with existing laws, regulations and the Forest Land and Resource Management Plan guidelines.*

In addition to the above, forest-wide standards and guidelines and management prescription area standards and guidelines should serve to reduce the potential impacts of Federal mineral leases. This includes a no-surface-occupancy for management prescription areas CV, DR, HR and CR. In addition, federally owned minerals are not available within management prescription area WD (Wilderness). Forest-wide standards and guidelines are listed below. Management area standards and guidelines are documented in Appendix H of the Forest Plan (USFS 2005c).

1. *FW28.1 (G) Exploration and development of federally owned leasable minerals, gas and oil and mineral materials may be allowed where compatible with the management prescription. Site-specific consent-to-lease analysis precedes the issuance of leases by the U.S. Department of Interior Bureau of Land*

Management. All land is available for non-surface-disturbing exploration. Surface-disturbing mineral activity, including core-drilling, may be allowed in most areas, especially where there is potential to discover minerals of compelling domestic significance as identified by the Bureau of Land Management. No seismic testing would be done from 11/15-4/1 within 4km (2.5 miles) of known Indiana or gray bat hibernacula.

This guideline will protect hibernating Indiana bats from disturbance due to seismic activities during the winter period.

2. *FW28.3 (S) Borrow Pits and Reserve Pits – Commercial borrow and reserve pits shall not be allowed.*

Implementation of this standard should greatly limit the surface area disturbed by mineral extraction activities, thus reducing the amount of potential Indiana bat habitat impacted.

Reclamation activities generally involve the restoration of surface resources affected by mining activities. For this reason, much of the roosting habitat and aquatic resources impacted by mineral extraction should be restored over the long-term. This would lead to the restoration/creation of potential roost trees and drinking water sources, thus potentially improving reproductive success, foraging success and fitness. Negative fitness consequences are not anticipated as a result of reclamation activities.

Recreation Management

Recreation Management on the Forest can be broken down into the following categories: developed recreation, equestrian/hiking trail construction, and dispersed recreational activity.

Developed recreation areas contain some habitat suitable for Indiana bat use. However, these facilities are a minor component of the land base on the Forest (0.6%). The amount of habitat within these areas is not expected to change. Although recreational activities have the potential to disturb roosting Indiana bats (primarily males or non-reproductive females), the probability is very low (discountable) based on the amount of area affected by developed recreation. No additional recreational facilities (e.g., picnic areas, campgrounds) are proposed for development in the Proposed Plan. Therefore, this type of action is not anticipated to adversely impact Indiana bats.

Approximately 235 miles of equestrian/hiking trail construction is anticipated in the next 10 years. Trails are typically constructed in an environmentally sensitive manner, avoiding the loss of large trees. With implementation of Indiana bat standards and guidelines potential Indiana bat roost trees should be avoided. Given the small number of potential roost trees that may be affected, it is not anticipated that any unknown, occupied roost trees would be lost. Thus, this is not expected to be an activity that would result in negative fitness consequences for Indiana bats. The construction of trails that maintain a canopy can provide benefits for Indiana bats by creating new flight corridors for travel

and foraging. This could lead to decreases in energy expenditures resulting in increased fitness and potentially population stability or increase.

Dispersed recreational activities occur throughout the Forest. This includes hiking, hunting, bird watching, nature viewing, and rock climbing. Although it is possible that individuals (e.g., hikers) may pass near roost trees with Indiana bats which may result in some disturbance, we do not expect a negative fitness consequence to occur. Furthermore, given the dispersed nature of these activities compared to the large number of potential roost trees occurring on the Forest, the likelihood of hikers disturbing roosting bats is extremely low (i.e., discountable).

Spelunking and cave visitation is another dispersed recreational activity which could have direct impacts on Indiana bats. Indiana bat standards and guidelines restrict recreational use of caves and abandoned mines used by roosting and hibernating Indiana bats. This should prevent and/or greatly limit potential adverse effects. Caves and mines with the highest amount of Indiana bat use and controlled by the SNF have been gated and/or fenced to restrict human use. Therefore it is not anticipated that spelunking and cave visitation by recreational users will have adverse impacts on Indiana bats. Cave management is discussed further below.

Large Openland Management

Activities that may be seen in management prescription area LO include prescribed burning, non-native invasive species control, plowing and disking, pond maintenance and trail/minor recreation construction. The physical, chemical and biotic changes/impacts associated with these activities are discussed above under Timber Harvest/Management, Integrated Pest Management, Pond/Waterhole Creation and Management and Recreation Management. We do not anticipate any adverse fitness consequences in response to these environmental impacts as large openlands are not utilized to any significant degree by Indiana bats.

Range Management

Range management is limited on the Forest and occurs primarily on the Dixon Springs Agricultural Center as part of research. Mowing and selling of hay is allowed as a vegetation management tool. There are no physical, chemical, biotic changes/impacts anticipated as part of these activities that would impact Indiana bats.

Soil, Water and Air Management

The Forest has proposed a number of forest wide standards and guidelines to maintain soil, water and air quality on the Forest. The following are the proposed forest-wide standards and guidelines applicable to protection of soil/water and riparian corridors (filter strips) and riparian areas:

1. *FW25.1 (G) Forest-management activities should conserve soil and water resources and assure the protection of streams, streambanks, lakes, wetlands and other bodies of water in accordance with applicable laws and regulations. Activities should be guided by the best-management practices defined by the Illinois Department of Natural Resources Division of Forest Resources (October 2000) and may include streambank restoration and/or stabilization, and management of large woody debris.*

2. *FW25.2(S) Riparian corridor (filter strip) and riparian-area Forest-wide standards and guidelines shall supersede other, less restrictive, management prescription area standards and guidelines. Filter strips shall be established adjacent to lakes, wetlands, perennial streams, intermittent streams and ephemeral streams, except in the Oakwood Bottoms Greentree Reservoir and Mississippi and Ohio River Floodplains management prescription areas. Table 5-2 describes the minimum widths of filter strips along perennial and intermittent streams and lakes. The minimum filter-strip width along the edge of wetlands should be 100 feet and along ephemeral streams 25 feet. Riparian corridors along perennial and intermittent streams, and along lakes and wetlands are not part of the suitable timber base.*

Table 5-2. Riparian corridor (filter-strip) guidelines

Adjacent land-slope	*Perennial stream filter-strip width (feet)*	*Intermittent stream filter-strip width (feet)*
< 10 percent	*100*	*50*
20	*130*	*65*
30	*170*	*85*
40	*200*	*100*
50	*250*	*125*
60+	*300*	*150*

3. *FW25.3 (S) All disturbed areas that would cause significant impairment of the productivity of Forest land, downstream water resources, or aquatic/riparian habitat shall be promptly restored. Native vegetation should be used to restore disturbed areas and shall be used when seed is available and affordable.*

Implementation of these forest-wide standards and guidelines should ensure maintenance of water quality across the Forest. This will ensure maintenance of Indiana bat drinking water quality. Riparian corridor guidelines will ensure protection of important Indiana bat foraging habitat and prey resources.

In addition to the above, the Forest proposes to implement of number of forest-wide standards and guidelines for air quality and smoke management. The most important relative to Indiana bats are listed below:

1. *FW25.8 (S) Emissions from Forest Service activities and related mitigation measures must comply with applicable state standards. Present and potential*

impairment of Forest resources attributable to air pollution will be identified to the Forest Supervisor.

2. *FW51.2.1 (S) All management-ignited prescribed fires shall be carried out in accordance with the provisions of an approved burning plan, in accordance with manual direction and other appropriate guidelines and direction.*

3. *FW 51.2.1.1 (S) Smoke-management planning is used to control the effects of smoke emissions and meet air-quality standards. During prescribed fires, consideration shall be given to smoke-sensitive areas that may lie downwind of the burn.*

Implementation of these forest-wide standards and guidelines for air quality and smoke management will ensure maintenance of air quality across the Forest. Good air quality is important for overall health of Indiana bats.

Cave Management

Cave resources will be managed to protect Indiana bats from disturbance during roosting and hibernation to the greatest extent practical. As mentioned above, the caves and abandoned mines with highest Indiana bat use and under control of the Forest Service are gated and/or fenced to control use. The following Indiana bat and forest-wide standards and guidelines have been developed to protect Indiana bats during roosting/hibernation and to protect cave resources:

1. *In caves and mines with documented summer use prohibit access when necessary to prevent disturbance of bats between March 15 and October 31 and with documented winter use, prohibit access when necessary to prevent disturbance between September 15 and April 30.*

2. *Prohibit any significant disturbance such as prescribed burning and smoke generation and tree cutting except for bat habitat enhancements within approximately 100 feet of a cave entrance or open abandoned mine entrance when occupied by bats.*

3. *Retain a forested corridor between caves or abandoned mines that are being utilized by bats and foraging areas (stream or reservoir)*

4. *Consider acquisition of caves and abandoned mines discovered to contain populations of Indiana and/or gray bats and those caves determined to be of regional significance that are within the proclamation boundary of the National Forest. IDNR and USFWS biologists will identify regionally significant caves or mines for Indiana or gray bats on the Forest.*

5. *FW23.13.3(G) Vegetation should be managed to maintain or enhance the natural microclimate surrounding the entrance of all caves.*

Implementation of these standards and guidelines should ensure protection of Indiana bat cave and abandoned mine habitats. Protection of the environmental conditions surrounding the caves and protection from disturbance should improve hibernating conditions and reproductive fitness for Indiana bats.

Land Ownership and Adjustment

Implementation of the 2006 Forest Plan will involve some land acquisition (from willing sellers) that will primarily include acquisition of hardwood forests or river floodplains. Such action would have long-term benefits for Indiana bats as new habitat is protected and/or restored over time.

Special use permits are issued for existing right-of-ways for road repair and maintenance of utilities. Few, if any, trees would be impacted by the issuance of special-use-permits for maintenance. In a few instances, new road right-of-ways across the Forest may need to be cleared of hardwood trees. However, with the application of Indiana bat standards and guidelines and given the small increment of forested habitat impacted, these activities are not likely to result in adverse fitness consequences for Indiana bats. The potential indirect effects associated with issuing new right-of-way permits cannot be assessed at this stage due to the uncertainty of the kinds of actions that may occur.

Hazard Tree Removal

Hazard trees are removed as a matter of safety. These trees may be removed as a part of any of the above referenced management activities. Hazard trees are often dead trees that are potentially suitable for Indiana bat roosting. These trees will be evaluated for Indiana bat use prior to being removed, in accordance with Indiana bat standards and guidelines. Therefore, it is unlikely that an occupied roost tree will be cut. In addition, this represents a very minute component of potential roost trees located on the Forest. For this reason it is not expected that incidental take of Indiana bats will occur as a result of hazard tree removal.

Monitoring and Research

Monitoring and research of Indiana bat use of the Forest will continue during Forest Plan implementation. This will include mist-net surveys associated with specific projects, hibernacula surveys and, possibly, continuation of telemetry studies. Mist net surveys have the potential to disrupt foraging/feeding behavior. The energy budget is disrupted as energy is expended to escape the nets and additional time is required for foraging. This may lead to displacement of individual bats but is not likely to result in direct mortality. However, some amount of mortality may occur as a result of bats becoming entangled in nets.

Hibernacula surveys may also disrupt hibernating bats. This disrupts the energy budget of the hibernating bats which may lead to reduced reproductive success. However, only individuals experienced with bats and surveying hibernacula are permitted to conduct

surveys and handling of bats is minimized. Therefore, it is not expected that this activity would result in mortality of individuals.

Telemetry studies have been conducted on the Forest to gather information on Indiana bat ecology. Placing transmitters on Indiana bats results in a minor increase in weight and may temporarily disrupt foraging and feeding behavior. Bats will often groom themselves in an effort to remove the transmitters. Indiana bat energy budgets are temporarily disrupted. As only qualified individuals are allowed to implement these types of studies, the effects are generally minor.

The following Indiana bat standards and guidelines apply to monitoring and research activities for Indiana bats:

1. *Personnel conducting mist-netting, cave surveys and other monitoring activities requiring the handling of bats, will be adequately trained by experience personnel. Mist-netting procedures developed by Garner and Gardner (1992) or other USFWS approved bat monitoring procedures will be used. An annual report of bat-monitoring activities and involved personnel will be provided to the Marion, Illinois office of the U.S. Fish and Wildlife Service. Any bats that are incidentally killed during monitoring will be placed on ice or frozen and brought to the Marion office as soon as possible. Any incidental taking of Indiana and/or gray bats will be reported to the Marion office within three business days.*

Implementation of the standard will ensure that only appropriately trained individuals will conduct monitoring and/or research activities. This should greatly reduce, but not eliminate, the potential for incidental take associated with monitoring and/or research.

Species Response to the Proposed Action

The implementation of the 2006 Forest Plan affords many long term benefits to Indiana bats using the SNF. Some projects may have short term fitness consequences for individuals. We now assess the implications in terms of populations and species level response to changes in individuals' fitness.

Hibernating Populations

Populations of hibernating Indiana bats on the SNF will be protected from human disturbance through gating and monitoring of those gates and restrictions that prohibit disturbance during the time when bats are present. Newly discovered hibernacula will be evaluated for their protection needs. Hibernacula are designated as smoke sensitive areas, alerting the SNF personnel of the need to plan prescribed fire in a way that minimizes or avoids smoke impacts to the cave or abandoned mine such that any effects would be insignificant or discountable. Physical disturbance to the immediate area (100 feet) around the cave will be very limited. Recreational opportunities are also very limited in the immediate area around a hibernaculum. Hibernacula on the SNF range from Priority 1 to Priority 3 hibernacula. The populations in these caves and abandoned

mines in 2004-2005 ranged from 153 to 33,500 Indiana bats. We expect that implementation of the 2006 Forest Plan will benefit hibernating Indiana bats by maintaining bat friendly gates that eliminate (or discourage) unnecessary human disturbance to hibernating bats, by monitoring potential trespass at known hibernacula, by periodically assessing hibernacula for physical changes that may trigger new protective management actions, and by working with partners to further stabilize abandoned mines currently being utilized by Indiana bats.

Swarming, Staging and Migrating Indiana Bats

Swarming and staging Indiana bats will be afforded many benefits with the implementation of the 2006 Forest Plan. Maintaining a 5-mile radius buffer around the hibernacula on or adjacent to the SNF will maintain suitable roosting and foraging habitat during these critical mating and fat building life history stages. It is anticipated that cutting of unknown occupied roost trees may occur as part of timber harvest/management, timber stand improvement and minerals management. However, we believe it is unlikely that a primary or high quality secondary roost tree would be undetected. Hence, only lesser quality roosting trees – those that harbor single or a few roosting bats – are likely to be cut. We do not expect all individuals who may be occupying a roost tree when it is cut will be injured or killed. As such, we anticipate only a few individuals are likely to be injured or killed. The loss of these individuals is not likely to affect the annual or long-term fitness of the population to which they belong. Reduced amounts of prescribed fire around hibernacula on an annual basis will ensure insect populations are maintained around hibernacula.

The migratory patterns of Indiana bats using the SNF are unknown. What we do know is that many Indiana bats migrate northward to maternity colonies (Gardner and Cook 2002). The overall forested character of the SNF will not change as site-specific projects are implemented. Within shelterwood harvest areas leave trees, including suitable roosting trees, will remain. Snag and cavity management will also ensure that many potentially suitable roost trees will be available across the forest. Foraging opportunities will remain available throughout the Forest. Forested corridors are abundant on the SNF, providing typical commuting corridors. Prescribed burning and harvest could occur when Indiana bats are migrating to or from their hibernacula. There are many potential travel corridors throughout the SNF. The probability that a migrating Indiana bat would be encountered, much less injured or killed, is very remote. Hence, no population fitness consequences are expected.

Maternity Colonies

There are two known maternity colonies on the SNF, both located in the Mississippi Bluffs Ranger District on the west side of the Forest. The historic Cedar Creek maternity colony is believed to be part of the Oakwood Bottoms maternity colony. Extensive surveys conducted in 1999 and 2000 (Carroll 2001) did not document additional maternity colonies on the Forest.

Protecting the known roosts, maintaining additional suitable roosts in perpetuity and maintaining small canopy gaps and/or opening the mid-story will benefit known maternity colonies on the SNF. These benefits can include more foraging opportunities and greater solar exposure for primary or alternate maternity roosts (Krusac and Mighton 2002, Miller et al. 2002).

Despite these benefits, direct adverse impacts may occur to maternity colonies. Specifically it is anticipated that cutting of unknown occupied roost trees may occur as a part of timber harvest/management, timber stand improvement, wetland management and minerals management may result. In addition, mist netting as a part of monitoring and research may also result in direct mortality of Indiana bats.

The probability of removing an unknown occupied roost tree through any management activity on the SNF is small, but not excluded, and depends upon the activity and location. As explained above, we expect only lesser quality roost trees to go undetected. As these trees are likely to harbor a single or a few roosting bats at any given time, we expect only small numbers to be affected. Furthermore, if an unknown occupied roost tree was cut during the maternity season, most of the bats would likely escape unharmed (Belwood 2002, Carter et al. 2002), however; some may be injured or killed (Belwood 2002), those being most likely non-volant juveniles. The loss of these lesser quality roosts are not likely to have any negative fitness consequences indirectly as the SNF will not be cutting all of the suitable roost trees in any one area. Given the forested landscape, suitable roosts are anticipated to be readily available for use by that colony (Kurta et al. 2002). However, we do not expect any negative fitness consequences for the maternity colonies occurring within the action area.

It is also likely that roosting and foraging opportunities for maternity colonies will increase as a result of the implementation of the 2006 Forest Plan. Management activities that create small canopy gaps, open up the understory and create a diversity of habitats will mimic the landscape that was available to Indiana bats when their numbers and distribution were greater than they are today (USFS 2005e).

"Summering" Males and Non-reproductive Females

Given the number of Indiana bat hibernacula in southern Illinois and on the SNF, and given that some males and non-reproductive females stay near their hibernaculum during the "summer" (non-hibernation season), we would expect some of the suitable roost trees on the SNF to be actually occupied at some point by these individuals.

If an occupied roost tree was being cut or burned, it is most likely that an individual Indiana bat using this roost, would arouse and fly away from the tree. It is very unlikely that the bat would stay in the tree and be crushed as the tree landed on the ground, however, injury may occur. While there is a slight risk of predation if the bat flew during the day, we do not think this risk is significant (Kurta et al. 2002). Since the SNF will not be cutting all of the suitable roost trees in any one area it is likely that suitable roosts will remain available for use by those individuals (Kurta et al. 2002). Thus, we do not expect

any negative population responses.

It is also likely that roosting and foraging opportunities for summering individuals will increase as a result of the implementation of the 2006 Forest Plan. Management activities that create small canopy gaps, open up the understory, and create a diversity of habitats will mimic the landscape that was available to Indiana bats when their numbers and distribution were greater than they are today (Miller et al. 2002, USFS 2005e).

Summary

Overall, we conclude that the risk of adverse fitness consequences occurring through the implementation of the 2006 Forest Plan is low. Further, we anticipate injury or death may occur to a single or few roosting bats. We do not expect that these changes in individual fitness will have any population or species level consequences. Rather, we believe the habitat improvements anticipated will improve individual fitness, and hence, population viability. Improving the viability of the populations summering and wintering within the action area could benefit the overall viability of the species.

We believe that an average of one unknown occupied roost tree may be cut per year for the first 10 years as a result of timber harvest/management, timber stand improvement, wetland management and minerals management activities combined. This is anticipated to result in the incidental take of 1 Indiana bat per year for the first 10 years of plan implementation. Since the acreage of habitat affected by management activities is proposed to increase in the second decade of plan implementation, we believe that an average of two unknown occupied roost trees may be cut per year in the second 10 years as a result of these management activities.

Since 1992, only one Indiana bat has died as a result of mist-netting activities on the SNF. We anticipate that mist netting activities for monitoring purposes will increase with plan implementation. For this reason, we believe two Indiana bats may be killed as a result of monitoring/research activities during the life of the 2006 Forest Plan.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonable certain to occur in the action area considered 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.

Non-public lands make up about 65 percent of the land base within the Forest boundary. Land use activities on these lands are determined by the owner. Some land use practices on these properties will benefit Indiana bats, some will have no effect and some will be detrimental. It is difficult to predict the types of practices that are reasonably certain to occur. However, firewood cutting and private logging on private land are common practices in southern Illinois. It occurs throughout the year, and therefore, unknown occupied roost trees could be cut. In most instances Indiana bat may escape, depending

upon the time of year, some could be injured or killed. It is impossible to calculate the numbers of Indiana bats that may be impacted by these activities. These activities also create canopy gaps and edge effects that likely improve foraging habitat and microclimate conditions in roost trees. This may have positive benefits for Indiana bats. It is unlikely that these activities change the character of the area to such an extent that individuals or colonies no longer survive. As the hibernating population of Indiana bat in the action area is stable/increasing, we do not believe these private actions have or will in the future adversely affect the viability of populations occurring within the action area.

Approximately 13% of the minerals located below Forest lands are non-federal or privately owned. As such, use of the Federal surface will be governed by the legal instrument that identifies the reserved and outstanding rights. For this reason, the Forest Service is limited in any requirements that may be imposed to provide protection to federally listed species. However, these mineral extraction activities, including oil and gas extraction, are regulated through state permitting. As such, impacts to threatened and endangered species still require consideration in the extraction of mineral resources.

Non-energy mineral and coal mining occurs on private land in southern Illinois as well. These mineral are often extracted via surface mines, resulting in impacts to forested habitats. These activities are permitted by the IDNR, therefore, it is expected that impacts to Indiana bats are minimized to some extent. Over the long-term reclamation activities may replace some of the impacted forest. However, this is not assured as often the land is reclaimed back to pasture or agricultural land.

Pesticides are applied to agricultural lands in southern Illinois to control insect infestations. Many of these chemicals end up in waterways and likely effect insect populations. In addition, some of these chemicals are persistent and may bioaccumulate in the environment. Therefore, pesticide use may have some significant detrimental impacts on Indiana bats. However, the scope of this impact is unknown.

CONCLUSION

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed 2006 Forest Plan for the Shawnee National Forest and the cumulative effects, it is the Service's biological opinion that the 2006 Forest Plan, as proposed, is not likely to jeopardize the continued existence of the Indiana bat. Critical habitat for this species has been designated at several major hibernacula, however, this action does not affect that area and no destruction or adverse modification of that critical habitat is expected.

Implementation of the proposed Plan is likely to result in some adverse fitness consequences for individuals 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 these individual consequences will elicit population or species-level effects. On the contrary, 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 populations in which these individuals belong to and on the species rangewide is 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 under 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 behavioral 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.

The measures described below are non-discretionary, and must be undertaken by the Shawnee National Forest so that they become binding conditions associated with the various actions or as part of any grant, permit, license or contract issued to an applicant, as appropriate, for the exemption of section 7(o)(2) to apply. The Shawnee National Forest has a continuing duty to regulate the activities covered by this incidental take statement. If the Shawnee National Forest (1) fails to assume and implement the terms and conditions, or (2) fails to require the applicant/contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, grant, license or contract document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Shawnee National Forest must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(I)(3)]

Relationship of Program-level Incidental Take Statement to Project-level Incidental Take Statement

Any future actions completed under the 2006 Forest Plan that may adversely affect the Indiana bat will require section 7 formal consultation. These consultations will proceed using the procedures outlined in the "Tiered Consultation Approach" section in the accompanying Biological Opinion (page 3). A Tier 2 biological opinion will be written for each project that may adversely affect the Indiana bat. During this Tier 2 consultation, project-specific incidental take, as well as 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 incidental take statements, 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 Anticipated

In this incidental take statement, we are evaluating the incidental take of Indiana bats that may result from the implementation of the 2006 Forest Plan for the SNF (loss of occupied roost trees through timber harvest/management, timber stand improvement, wetland management, minerals management, and monitoring/research). The 2006 Forest Plan is a comprehensive plan level document that allows and guides, but does not authorize site-specific actions to occur. With the implementation of the 2006 Forest Plan (and all of the standards and conditions within), we expect that some adverse impacts to Indiana bats may occur. As such, ***some*** site-specific projects (i.e., timber harvest/management, timber stand improvement, some wetland management projects, some minerals management projects) and monitoring/research activities, conducted under the 2006 Forest Plan may result in adverse effects to individual Indiana bats that rise to the level of take. The standards and guidelines proposed substantially reduce the potential for adverse effects and incidental take to occur as a result of actions implemented under the 2006 Forest Plan. Therefore, projects completed under the 2006 Forest Plan that comply with all of the standards and guidelines and other project commitments detailed in the BA (USFS 2005b) in many cases would not adversely affect the Indiana bat, therefore, no incidental take would occur in those instances. However, as described within the Effects section, unknown occupied roost trees could be removed, particularly during timber harvest/management and timber stand improvement, but also during wetland management and minerals management activities. We believe that no more than one such roost tree would be removed per year on average for the first 10 years of Forest Plan implementation. We believe that no more than two such roost trees would be removed per year on average during the second 10 years of Forest Plan implementation. The likelihood of such instances is strongly influenced by the timing and location of the activity within the SNF. In addition, we believe that no more than two Indiana bats will be killed as a result of monitoring/research activities during the life of the 2006 Forest Plan.

The project period analyzed for the 2006 Forest Plan is 10-20 years. Therefore, we anticipate that up to 30 occupied roost trees might be removed through timber harvest/management, timber stand improvement, wetland management and minerals management activities throughout the project period, causing possible incidental take of Indiana bats. Given the information presented in the accompanying biological opinion, it is most likely that solitary males and/or a few non-reproductive females would occupy such trees.

Incidental take of Indiana bats is difficult to detect for the following reasons:

1. The individuals are small and occupy summer habitats where they are difficult to find;
2. Males and non-reproductive females may roost individually, which makes finding the species or occupied habitats difficult;
3. Finding dead or injured specimens during or following project implementation is unlikely;
4. The extent and density of the species within its summer habitat on the SNF is largely unknown but is thought to be limited based on extensive survey efforts and current capture data, except within occupied habitat around hibernacula and maternity colonies; and,
5. Implemented actions will not affect the entire available habitat within a project area as a result of timber harvest/management, timber stand improvement, wetland management and minerals management.

Since the number of Indiana bats that may be taken through the implementation of the 2006 Forest Plan cannot be easily monitored and it is unlikely that we would ever notice when an unknown occupied roost tree was cut, it is appropriate to use a surrogate to **monitor** the level of take that may occur. We anticipate that take may occur from the loss of an unknown occupied roost tree.

Actions that may cause the removal of potentially suitable snags and/or live roost trees include timber harvest/management, timber stand improvement, wetland management, and minerals management. Incidental take will be monitored using the number of acres provided in Table 25. Although this surrogate will not give us the number of bats taken, it will provide a threshold in which above those acres we may expect our incidental take estimate to be exceeded. The amount of forest potentially impacted by minerals management is difficult to predict, but is anticipated to be low given the past level of activity on the Forest. The total amount of forest impacted by timber harvest/management is increased by 10% to account for forest impacted by minerals management. In addition, the amount of forest impacted by wetland management is also difficult to predict, but is also anticipated to be low. The total amount of timber stand improvement is increased by 5% to account for forest impacted by wetland management.

Table 25. Annual estimated management activities causing removal of Indiana bat habitat on the SNF.

Activity	Measure First 10 Years	Measure Second 10 Years	Measure Total
Timber Harvest/Management and Minerals Management	11,565 acres total	21,255 acres total	32,820 acres total
Timer Stand Improvement and Wetland Management	5,630 acres total	13,289 acres total	18,919 acres total
Total	17,195 acres total	34,544 acres total	51,739 acres total

In addition, we believe that up to 2 Indiana bats may be killed during the project period as a result of monitoring and research activities.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

The annual incidental take associated with the removal of occupied roost trees (see above) spread over 50,563 acres (the surrogate measure to monitor incidental take) constitutes 1% of the forested area on the SNF being affected by activities that may cause incidental take, per year (50563 acres/20 years) 251,850 forested acres X 100 = 1.0%). Based on this analysis, an abundance of forested habitat will be available to Indiana bats on the SNF annually and throughout plan implementation, therefore, the impacts of the incidental take outlined above are small.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary to minimize the impacts of incidental take of Indiana bats:

1. Decrease possible adverse impacts to Indiana bats due to the removal of suitable roost trees during timber harvest/management, timber stand improvement, wetland management and minerals management through compliance with Terms and Conditions set forth below.

2. Monitor the status of Indiana bats on lands managed by the SNF.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Shawnee National Forest must comply with the following terms and conditions, which carry out the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. To reduce the possible impacts to Indiana bats due to the removal of potentially suitable roost trees from timber harvest/management, timber stand improvement, wetland management and minerals management, the following is necessary:

a. During site specific project planning, the effects of management on suitable roosting and foraging habitat in the 5-mile radius around known hibernacula and maternity colonies must be considered and such habitat must be maintained or enhanced in that area. The maintenance and enhancement of Indiana bat habitat can be accomplished through implementation of Indiana bat standards and

guidelines and/or implementation of additional site-specific measures as deemed appropriate on a site-specific basis.

2. To monitor the status of Indiana bats on the SNF:

a. Continue monitoring occupied Indiana bat hibernacula and maternity colonies on the SNF to assess changes in population numbers, changes in microclimate, the effectiveness of protective structures in place, etc.

b. Continue monitoring the extent of use by Indiana bats on the SNF. Such monitoring should include the employment of currently accepted techniques used to gather information on the Indiana bat on the SNF. Surveys should be prioritized based on the probability of having Indiana bat use and/or more optimal habitat conditions.

c. Habitat use at all sites where Indiana bats are documented on the SNF should be characterized and quantified at both local and landscape levels using GIS and/or other advanced computer software.

d. Develop and implement methods to determine estimated Indiana bat habitat available before and after site-specific project implementation. Provide that information in site-specific project biological evaluations.

e. Monitor the number of suitable roost trees available to the species on the SNF using Forest Inventory Assessment (FIA) data once every five years at a minimum.

f. The results of monitoring activities shall be provided to the Service's Marion, Illinois Ecological Services Field Office and the IDNR no later than December 31 of each year.

g. Provide to personnel of the Service's Marion, Illinois Ecological Services Field Office, and to IDNR, an opportunity to conduct site visits to all Districts of the SNF, to evaluate compliance of monitoring requirements. Site visits will be scheduled by mutual consent of the Service and personnel of the SNF.

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 December 21 of each year that specifies:

a. The amount of suitable habitat impacted by timber harvest and mineral management activities in the current year and the total impacted since issuance of this Biological Opinion and Incidental Take Statement;
b. The amount of habitat affected by timber stand improvement and wetland management in the current year and the total since issuance of this Biological Opinion and Incidental Take Statement;
c. Progress and results of any terms and conditions that were required, identified by project; and,
d. The number of live or dead Indiana bats encountered.

2. Care must be taken in handling dead bat specimens that are found to preserve biological material in the best possible condition.

3. Any dead specimens should be placed in a plastic bag and refrigerated as soon as possible following discovery.

4. Upon locating any dead, injured or sick Indiana bats, initial notification must be made to the Fish and Wildlife Service Ecological Service Office at Marion, Illinois. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

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. The Service anticipates that during the first 10 years of Forest Plan implementation, no more than 10 occupied roost tree will be incidentally taken, or for monitoring practicality, no more than 17,195 acres of activities where suitable roost trees are likely to be removed during the first 10 years of Forest Plan implementation. The Service anticipates that during the second 10 years of Forest Plan implementation, no more than 20 occupied roost trees will be incidentally taken, or for monitoring practicality, no more than 34,544 acres of activities where suitable roost trees are likely to be removed during the second 10 years of Forest Plan implementation. In sum, the Service anticipates that no more than 30 occupied roost trees will be incidentally taken, or for monitoring practicality, no more than 51,739 acres of activities where suitable roost trees are likely to be removed over the life of the 2006 Forest Plan.

The Service anticipates that no more than 2 individual Indiana bats may be killed due to monitoring and/or research during the life of the 2006 Forest Plan.

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 use 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 carry out recovery plans, or to develop information.

The Service recommends that the SNF implement the following conservation measures to benefit Indiana bats:

● Implement, or cooperate to implement, research aimed at understanding the movement patterns of Indiana bats roosting in abandoned mines on the west side of the Forest. This should include understanding movement between hibernacula and movement between hibernacula and maternity sites. Provide a copy of the annual results of such studies to the Service's Marion, Illinois Ecological Services Field Office by December 31 of each year.

● In order to develop information on the Indiana bat, cooperate with the Service, IDNR, the North Central Research Station and any other interested agency, to complete a proposed study on the effects of forest management activities on the Indiana bat. Provide a copy of the annual results of such a study to the Service's Marion, Illinois Ecological Services Field Office by December 31 of each year.

● For successful implementation of the 2006 Forest Plan, conduct a workshop, in coordination with the Service, which will inform District personnel (including but not limited to biologists, planners, and timber and fire management officers) on the practical application of all standards and guidelines applicable to the Indiana bat and other listed species. This workshop should include a section on writing complete site-specific biological assessments/evaluations that tier to this programmatic biological opinion and the programmatic biological assessment. In addition, continue to conduct training for employees of the SNF, as appropriate, on bats occurring on the National Forest, including bat identification, biology, habitat requirements, and sampling techniques.

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

REINITIATION NOTICE

This concludes formal consultation of the actions outlined in the biological assessment for the 2006 Forest Plan for the Shawnee National Forest. As written in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Forest Service 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 SNF action that may affect listed species in a manner or to an extent not

considered in this opinion; (3) the SNF action is later modified in a manner that causes an effect to the listed species 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 operation causing such take must cease until reinitiation.

APPENDIX A

STANDARDS AND GUIDELINES FOR FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES

Gray Bat and Indiana bat

Caves and mines

- In caves and mines with documented summer use prohibit access when necessary to prevent disturbance of bats between March 15 and October 31 and with documented winter use, prohibit access when necessary to prevent disturbance between September 15 and April 30.

- Prohibit any significant disturbance such as prescribed burning and smoke generation and tree cutting except for bat habitat enhancements within approximately 100 feet of a cave entrance or open abandoned mine entrance when occupied by bats.

- Retain a forested corridor between caves or abandoned mines that are being utilized by bats and foraging areas (stream or reservoir)

- Consider acquisition of caves and abandoned mines discovered to contain populations of Indiana and/or gray bats and those caves determined to be of regional significance that are within the proclamation boundary of the National Forest. IDNR and USFWS biologists will identify regionally significant caves or mines for Indiana or gray bats on the Forest.

- FW23.13.3 (G) Vegetation should be managed to maintain or enhance the natural microclimate surrounding the entrance of all caves.

Indiana Bat Roosting Habitat

- Known maternity roosting habitats (within SNF) include bottomland hardwoods, shrub-swamps and riparian forests. In known maternity roosting habitat, 50 percent to 75 percent of the basal area of live trees should be greater than eleven inches diameter at breast height where possible. This would not be possible on every acre. In order to provide for retention, recruitment and mortality in hardwood forests, it would only apply to an entire maternity roost habitat area such as the entire Oakwood Bottoms Greentree Reservoir. Management will include a preponderance of species that exhibit exfoliating bark characteristics. Typical species include American elm (*Ulmus americana*), slippery elm (*Ulmus rubra*), eastern cottonwood (*Populus deltoides*), bitternut hickory (*Carya cordiformis*), shellbark hickory (*Carya laciniosa*), shagbark hickory (*Carya ovata*) and species in the red oak group (*Quercus* spp.). Known roosting habitats should contain an abundance of canopy gaps. Crown-closure (of live trees greater than eleven inches in

diameter at breast height of all species) should be between 30 percent and 80 percent, where possible (i.e., this is not possible in shrub-swamps).

- Within 5 miles of known roosts or hibernacula, known roost trees will not be cut down or removed through harvesting. Management of forests should include maintaining a diversity of age, size and species classes of potential roost trees. It should also include the maintenance of existing forested landscapes, snag and live tree retention, riparian corridors and hibernacula protection and improvement projects. When removal of dead trees or trees with exfoliating bark is needed for safety or to accomplish project objectives during 4/1 – 11/15, they will be evaluated (including exit surveys if needed) for bat usage prior to removal. Potential roost tees cannot be removed during these periods unless they are evaluated (biological evaluation done by biologists) and/or surveyed to document non-use by roosting bats. Surveys could include mist netting of sale areas, exit surveys for individual trees or other surveys approved by the U.S. Fish and Wildlife Service.

- Greater than 5 miles from known hibernacula and maternity roost areas, potential roost trees that include live hardwood trees with exfoliating bark would not be removed from 4/1 – 9/30 unless necessary for human safety or to accomplish project objectives. Removal of these trees during the above roosting period requires evaluation and/or surveys to determine non-use by roosting bats. Surveys could include mist-netting of sale areas, exit surveys for individual trees or other surveys approved by the U.S. Fish and Wildlife Service.

- In all project areas across the Forest where large overstory, hardwood trees will be cut, mist-netting surveys, exit surveys or other surveys approved by the U.S. Fish and Wildlife Service would be done prior to harvest or cutting to identify known roosting habitats. Mature leave trees in areas where the shelterwood and shelterwood with reserves harvest methods are applied (including throughout the uplands) will include mixtures of the following tree species preferred by Indiana bats for roosting where they exist: silver maple (*Acer saccharinum*), bitternut hickory (*Carya cordiformis*), shellbark hickory (*Carya laciniosa*), shagbark hickory (*Carya ovata*), white ash (*Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoides*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), post oak (*Quercus stallata*), black locust (*Robinia pseudoacacia*), American elm (*Ulmus americana*), and slippery elm (*Ulmus rubra*).

<u>Dead trees</u>

- Retain all standing dead trees unless necessary to cut for human safety or to accomplish project objectives. Dead trees that are potential roost trees cannot be removed from 4/1-9/30 greater than 5 miles from known hibernacula or maternity roosting habitats and from 4/1-11/15 less than or equal to 5 miles from known hibernacula or maternity roosting habitats unless they are evaluated (biological evaluation by biologists) and/or surveyed to document non-use by roosting bats.

Monitoring and Reporting

- Personnel conducting mist-netting, cave surveys and other monitoring activities requiring the handling of bats, will be adequately trained by experience personnel. Mist-netting procedures developed by Garner and Gardner (1992) or other USFWS approved bat monitoring procedures will be used. An annual report of bat-monitoring activities and involved personnel will be provided to the Marion, Illinois office of the U.S. Fish and Wildlife Service. Any bats that are incidentally killed during monitoring will be placed on ice or frozen and brought to the Marion office as soon as possible. Any incidental taking of Indiana and/or gray bats will be reported to the Marion office within three business days.

Fire Management

- FW51.2.1.1 (S) Smoke-management planning is used to control the effects of smoke emissions and meet air-quality standards. During prescribed fires, consideration shall be given to smoke-sensitive areas including Indiana or gray bat hibernacula that may lie downwind of the burn.

- FW51.2.1.2 (S) Burns within 0.25 miles of any Indiana or gray bat hibernacula shall be conducted under conditions that will reduce or eliminate smoke dispersing into the hibernacula.

- FW51.2.1.3 (S) To reduce the chances of affecting maternity roosts and foraging habitats, no prescribed burns shall be done in upland forest from 5/1-9/1 and in bottomland forests from 4/1-9/1. No burning shall be done in forested areas of Oakwood Bottoms during the spring seasons, 3/1-4/1 annually. Only 30% (approximately 1,900 acres) of the Big Muddy bottomlands (approximately 6,200 acres of National Forest) east of the Big Muddy levee shall be burned (blackened) annually during spring burning seasons.

- FW51.2.1.4 (S) To reduce the chances of adversely affecting Indiana bat, male roosting habitat within 4km (2.5 miles) of surrounding known hibernacula, no more than 20% of the habitat in this zone shall be burned (blackened) annually. Within 4km-8km (2.5 to 5 miles) surrounding known hibernacula, no more than 50% shall be burned (blackened) annually.

Minerals Management

- FW28.1 (G) Exploration and development of federally owned leasable minerals, gas and oil and mineral materials may be allowed where compatible with the management prescription. Site-specific consent-to-lease analysis precedes the issuance of leases by the U.S. Department of Interior Bureau of Land Management. All land is available for non-surface-disturbing exploration. Surface-disturbing mineral activity, including core-drilling, may be allowed in most areas, especially where there is potential to discover

minerals of compelling domestic significance as identified by the Bureau of Land Management. No seismic testing would be done from 11/15-4/1 within 4km (2.5 miles) of known Indiana or gray bat hibernacula.

Environmental Management

- FW21.1 (G) The use of pesticides and biological treatments is allowed following appropriate environmental consideration that indicates use will meet management objectives. Protective measures will be implemented where needed wherever aquatic pesticides would be used and near stream courses wherever terrestrial pesticides would be used.

Mead's Milkweed

- Expand current populations into restored habitat through the use of propagated plants.

- Where impacts occur or are expected to occur as a result of recreational use adjacent to known populations, implement corrective actions as needed to avoid or stop the impact.

- Manage and expand existing habitat through the use of prescribed burning and other management tools. Prescribed burns would take place between the end of October and the end of March (when dormant) to stimulate flowering.

- Remove critical shading trees and shrubs as needed to perpetuate the species.

- Where non-native invasive species are invading occupied habitat, utilize control measures necessary to eradicate these undesirable species. In order to avoid negative impacts to Mead's milkweed, treatments should take place between the end of October and the end of March (dormant season).

Bald Eagle

- Prohibit disturbances within approximately 300 feet of each eagle nest, except as necessary to protect the nest.

- Prohibit significant changes in the landscape within approximately 600 feet of an eagle nest.

- Restrict management activities that result in adverse disturbance to nesting birds within approximately 1,300 feet of an eagle nest during the nesting period.

- Identification of winter bald eagle feeding and roosting areas and prohibiting land use that would destroy or otherwise render these areas unsuitable.

Least Terns

Least terns are not known to nest on the Shawnee National Forest. In the event that this species nests on National Forest System lands, the following guidelines will apply:

- Prohibit controllable disturbances within identified nest colony sites between May 15 and August 15.

- Prohibit sand and gravel operations that remove or destroy identified nesting colonies.

- Implement management recommendations as developed in the Recovery Plan.

APPENDIX B

HIBERNACULA: FOREST HABITAT ANALYSIS

Table 1: Forested habitat located within 5-mile radius of Indiana bat hibernacula and/or summer bachelor colony sites. Data courtesy of U.S. Forest Service.

Hibernacula and Bachelor Colonies	Forested Land on National Forest within 5-mile radius (acres)	Forested Land on Private/Other within 5-mile radius (acres)	Total Forested Land within 5-mile radius (acres)	Total Forested Land Affected by Prescribed Fire by Forest Service Annually*** (acres + percentage)	Total Forested Land within 5-mile radius unaffected by Prescribed Fire (acres + percentage)
Magazine Mine	16,163.1	13,782	29,945.1	6,605.25 (22.1%)	23,339.85 (77.9%)
Mine #30	22,380.4	12,081.7	34,462.1	8,911.1 (25.9%)	25,551 (74.1%)
Barney Grace Mine	16,784.7	13,554.1	30,338.8	6,735.8 (22.2%)	23,603.3 (77.8%)
Jason Mine	14,857.9	11,782.7	26,586.6	5,947.9 (22.4%)	20,638.8 (77.6%)
Mine #26	14,263	13,115	27,378	5,590.1 (20.4%)	21,787.9 (79.6%)
Ellis Cave	18,038.4	16,006.1	34,044.5	7,424.7 (21.8%)	26,619.8 (78.2%)
Toothless Cave	28,468.3	8,211.5	36,679.8	12,185.5 (33.2%)	24,494.4 (66.8%)
Brasher Cave	12,598.1	11,513.7	24,111.8	4,388.1 (18.2%)	19,723.8 (81.8%)
Griffith Cave	8,036.8	13,104.9	21,141.7	3,427.1 (16.2%)	17,714.6 (83.8%)
Cave Springs Cave	12,066.4	15,268.3	27,334.7	5,278.7 (19.3%)	22,056 (80.7%)

***** Acreage estimates represent the maximum amount of forested habitat that can be burned (blackened) within a 5-mile radius of hibernacula in any given year. Prescribed fire will not occur around all the hibernacula in a single year, but will be staggered during the course of implementing the 2006 Forest Plan.**

Table 2: Forested habitat located within 2.5-mile radius of Indiana bat hibernacula and/or summer bachelor colony sites. Data courtesy of U.S. Forest Service.

Hibernacula and Bachelor Colonies	Forested Land on National Forest within 2.5-mile radius (acres)	Forested Land on Private/Other within 2.5-mile radius (acres)	Total Forested Land within 2.5-mile radius (acres)	Total Forested Land Affected by Prescribed Fire by Forest Service Annually*** (20%) (acres)	Total Forested Land within 2.5-mile radius unaffected by Prescribed Fire (acres)
Magazine Mine	4,921	3,955	8,876	984.2	7,891.8
Mine #30	7,597	2,757	10,354	1,519.4	8,834.6
Barney Grace Mine	5,523	3,746	9,269	1,104.6	8,164.4
Jason Mine	4,937	2,729	7,666	987.4	6,678.6
Mine #26	5,138	3,006	8,144	1,027.6	7,116.4
Ellis Cave	5,315	3,237	8,552	1,063	7,489
Toothless Cave	6,829	2,915	9,744	1,365.8	8,378.2
Brasher Cave	6,370	2,643	9,013	1,274	7,739
Griffith Cave	1,971	3,973	5,944	394.2	5,549.8
Cave Springs Cave	2,515	4,902	7,417	503	6,914

***** Acreage estimates represent the maximum amount of forested habitat that can be burned (blackened) within a 2.5-mile radius of hibernacula in any given year. Prescribed fire will not occur around all the hibernacula in a single year, but will be staggered during the course of implementing the 2006 Forest Plan.**

Table 3: Forested habitat located within 2.5-5.0-mile radius of Indiana bat hibernacula and/or summer bachelor colony sites. Data courtesy of U.S. Forest Service.

Hibernacula and Bachelor Colonies	Forested Land on National Forest within 2.5-5.0-mile radius (acres)	Forested Land on Private/Other within 2.5-5.0-mile radius (acres)	Total Forested Land within 2.5-5.0-mile radius (acres)	Total Forested Land Affected by Prescribed Fire by Forest Service Annually*** (50%) (acres)	Total Forested Land within 2.5-5-mile radius unaffected by Prescribed Fire (acres)
Magazine Mine	11,242.1	9,827	21,069.1	5,621.05	15,448.05
Mine #30	14,783.4	9,324.7	24,108.1	7,391.7	16,716.4
Barney Grace Mine	11,261.7	9,808.1	21,069.8	5,630.9	15,438.9
Jason Mine	9,920.9	8,999.7	18,920.6	4,960.5	13,960.2
Mine #26	9,125	10,109	19,234	4,562.5	14,671.5
Ellis Cave	12,723.4	12,769.1	25,492.5	6,361.7	19,130.8
Toothless Cave	21,639.3	5,296.5	26,935.8	10,819.7	16,116.2
Brasher Cave	6,228.1	8,870.7	15,098.8	3,114.1	11,984.8
Griffith Cave	6,065.8	9,131.9	15,197.7	3,032.9	12,164.8
Cave Springs Cave	9,551.4	10,366.3	19,917.7	4,775.7	15,142

***** Acreage estimates represent the maximum amount of forested habitat that can be burned (blackened) within a 2.5-5.0-mile radius of hibernacula in any given year. Prescribed fire will not occur around all the hibernacula in a single year, but will be staggered during the course of implementing the 2006 Forest Plan.**

APPENDIX C
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