PROGRAMMATIC BIOLOGICAL OPINION

FOR THE

MARK TWAIN NATIONAL FOREST

2005 FOREST PLAN

MISSOURI

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Consultation History

Informal consultation on the 2005 Forest Plan began in 2003. A Consultation Agreement between the Mark Twain National Forest (MTNF) and the U.S. Fish and Wildlife Service (Service), Columbia, Missouri Ecological Services Field Office (CMFO) (dated May 15, 2003) outlined the procedure for completing consultation on a 2005 Forest Plan for the MTNF. On June 25, 2003, the MTNF requested that the CMFO become a cooperating agency in the preparation of the 2005 Forest Plan. On June 27, 2003, the MTNF requested the Service's concurrence with the species list for the 2005 Forest Plan. Concurrence was provided to the MTNF on July 14, 2003. The CMFO accepted the MTNF's request to be a cooperating agency on July 15, 2003.

In 2004 and 2005, numerous meetings, emails and phone conversations occurred regarding the 2005 Forest Plan. Most of these communications consisted of exchanges between Ms. Jody Eberly (MTNF) and Ms. Theresa Davidson (CMFO). On January 27, 2005, the MTNF sent a copy of the Draft 2005 Forest Plan and Draft Environmental Impact Statement to the CMFO. The Service, through the Department of Interior (DOI) provided comments to the MTNF on those documents on April 27, 2005. Additional DOI comments were provided to the MTNF on May 17, 2005.

The MTNF submitted a Programmatic Biological Assessment (BA) and requested initiation of formal consultation on June 14, 2005. The Service agreed to the request for initiation of formal consultation on June 23, 2005. A complete consultation history can be found in Appendix A of this biological opinion.

BIOLOGICAL OPINION

Description of the Proposed Action

The Forest Service proposes to revise the 1986 Land and Resource Management Plan (1986 Forest Plan) for the MTNF. The 2005 Forest Plan would be used to guide all natural resource management activities on the MTNF to meet the objectives of federal law, regulations, and policy. **No project-level decisions have been considered or made during the revision process.**

The MTNF has 1,495,747 acres of land primarily in southern Missouri with one unit located north of the Missouri River (Cedar Creek unit). There are six Ranger Districts on the MTNF: Houston/Rolla/Cedar Creek Ranger District, Ava/Cassville/Willow Springs Ranger District, Eleven Point Ranger District, Poplar Bluff Ranger District, Salem Ranger District, and Potosi/Fredericktown Ranger District.

The MTNF is characterized by three distinct geological areas. The extreme northern portion of the Forest consists of glacial till. Cherty dolomites and sandstones dominate the majority of the Forest surfaces. The eastern part of the Forest, the St. Francois Mountains, is composed of exposed igneous rocks. Elevations across the Forest range from 350 – 1,700 feet above sea level.

The proposed action is to implement a program of ecological restoration and resource management activities on MTNF that will insure the perpetuation of healthy natural communities through time on MTNF and provide a variety of goods and services through time. During the NEPA process the MTNF examined ten alternatives, five in detail for management of the National Forest. Alternative 3 is the preferred alternative. This alternative was designed to balance restoration of natural communities with management and production of more traditional forest commodities. The emphasis is on improvement of forest health conditions, production of forest products and other multiple use benefits, and enhancement of ecological communities. Restoration efforts will be focused in areas identified as biologically rich. 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 2005 Forest Plan has two main goals: 1) to promote ecosystem health and sustainability and 2) to provide a variety of uses, values, products, and services. There are several sub-goals and objectives to meet each goal. These are described below:

Goal 1 – Promote Ecosystem Health and Sustainability

Goal 1.1 – Terrestrial Natural Communities (Maintain, enhance, or restore site-appropriate native natural communities, including the full range of vegetation composition and structural conditions.)

Objective 1.1a – Within Management Prescription 1.1 areas, apply management activities to move natural communities towards restoration in the distribution amounts shown in Table 1.

Table 1. Desired percentage of natural community types in Management Prescription 1.1 areas (U.S. Forest Service 2005b).

Subsection	Natural Community Types					
	Savanna	Open Woodland	Closed Woodland	Upland Forest	Ozark Fen	Glade
Current River Hills	0-1%	6-7%	9-10%	0-4%	683 acres	13 acres
Meramec River Hills	0-1%	3-4%	5-6%	0-2%	0	5 acres
Black River Ozark Border	1-18%	13-26%	10-20%	0-3%	0	<1 acre
Central Plateau	1-8%	3-4%	14-19%	0-6%	0	7 acres
White River Hills	4%	15-17%	11-12%	0-6%	0	15-17%
St. Francois Knobs and Basins	0-2%	13-17%	15-20%	0-16%	0	140 acres
Gasconade River Hills	3-5%	9-17%	4-8%	0-1%	15 acres (1 area)	10
Claypan Till Plains	0-1%	0-1%	7-25%	0-30%	0	<1 acre

Objective 1.1b – Within Management Prescription 1.2 areas, apply management activities to move natural communities towards restoration in the distribution amounts shown in table 2.

Table 2. Desired percentage of natural community types in Management Prescription 1.2 areas.

Subsection	Natural Community Types					
	Savanna	Open Woodland	Closed Woodland	Upland Forest	Ozark Fen	Glade
Meramec River Hills	0-4%	4-6%	3-5%	0-1%	0	5 acres
Central Plateau	0-1%	0-1%	3-7%	0-28%	0	5 acres
White River Hills	4-5%	19-21%	14-15%	6-7%	0	19-21%
St. Francois Knobs and Basins	0%	5-6%	9-11%	11-15%	0	100 acres
Gasconade River Hills	3-5%	4-8%	1-3%	0-1%	191 acres (1 area)	9 acres

Goal 1.2 – Non-native Invasive Species (Maintain desired ecosystems throughout the forest with few occurrences on non-native invasive species. Prevent new invasions and control or reduce existing occurrences of non-native invasive species.)

Objective 1.2a – Control a minimum of 2,000 acres of existing noxious or non-native invasive species.

Goal 1.3 – Soils, Watershed, and Water Quality (Minimize erosion and compaction. Restore and maintain soil productivity and nutrient retention capacity. Protect the water quality and integrity of the watershed on Forest lands. Maintain healthy, sustainable, and diverse natural communities. Prevent wetland degradation and loss, and restore and enhance wetlands when possible. Establish and maintain riparian management and watercourse protection zones to: maintain, restore, and enhance the inherent ecological processes and functions of the associated aquatic, riparian and upland components within the riparian corridor; maintain streams in normal function within natural ranges of flow, sediment movement, temperature, and other variables; restore or maintain impaired waters as classified by section 303(d) of the Federal Clean Water Act; and protect and improve state and national outstanding resource waters.)

Objective 1.3a – Stabilize ten miles or more of stream reaches.

Objective 1.3b – Restore or enhance 125 acres of bottomland hardwood forest.

Objective 1.3c – Increase loading in 3 miles or more of in a stream or river to 100 to 3000 pieces of large woody material per stream mile.

Objective 1.3d – Protect and improve 900 acres of wetlands.

Goal 1.4 – Wildlife and Aquatic Habitat (Provide the range of natural habitats necessary to support populations of existing native plant and animal species. Restore and manage natural communities as the primary means of providing quality terrestrial, karst, and aquatic wildlife and rare plant habitat. Support recovery of Federal and State listed species, protection, and management of habitat for regionally listed species, and protection and management of habitat for other identified species of concern. Provide specialized habitats that are a healthy, functioning part of the larger landscape and require

no special protection or additional management considerations. Provide specialized habitat components (such as standing dead trees, cavity and den trees, downed woody material, temporary pools, ephemeral springs and seeps) across the landscape in amounts and types commensurate with the natural communities in which they occur. Encourage habitat that responds to demand for both consumptive and non-consumptive fish and wildlife use. Maintain native and desired non-native fish populations through habitat protection and enhancement and stocking programs.

Objective 1.4a – Improve open woodland conditions on at least 10,500 acres to provide habitat for summer tanager, northern bobwhite, Bachman's sparrow, and eastern red bat.

Objective 1.4b – Increase the proportion of managed native grasslands to that of exotic cool season grasses from the current 46% native grass to 55% native grass to provide habitat for northern bobwhite.

Objective 1.4c – Maintain forest or woodland cover over 85% or greater of MTNF acres to provide habitat for worm eating warbler.

Objective 1.4d – Treat at least 4,000 acres of glades to reduce woody vegetation to provide habitat for Bachman's sparrow.

Objective 1.4e – Designate permanent old growth on 8% to 12% of each 2.1 and 6.2 management areas and on 15% to 20% of each 6.1 management area.

Goal 2 – Provide a variety of uses, values, products, and services.

Goal 2.1 – Public Values (Within the capability of sustainable ecosystems, offer multiple benefits that contribute to the social and economic well-being of local and regional communities by providing a variety of uses, values, products, and services in a cost effective manner for present and future generations. Provide accessibility of the full range of uses, values, products, and services to members of underserved and low-income populations).

Goal 2.2 – Prescribed Fire, Fuels, and Wildland Fire Management (Reestablish the role of fire in the natural communities of the Ozarks by emulating the historic fire regime. Restore fire regime condition class two or three lands to condition class one. Reduce hazardous fuels. Reduce wildland fire risk to communities. Manage prescribed fires so that emissions do not hinder the State's progress toward attainting air quality standards and visibility goals. Provide well-planned and executed fire protection and fire-use programs that are responsive to values at risk and management area objectives.

Objective 2.2a – In addition to the traditional late-winter through early spring burn season, facilitate restoration treatments that emulate the range of natural variability for historical fire regimes in glades, savannas, and pine woodlands by: prescribed burning up to 20% of total projected burn acres from May through September; and prescribe burning up to 40% of total projected burn acres from September through December.

Objective 2.2b – Use prescribed fire to reduce hazardous fuels and improve Fire Regime Condition Class on 45,000 acres or more per year.

Objective 2.2c – Treat those fuels that pose moderate to high risk to communities or community infrastructure, and threatened and endangered species.

Objective 2.2d – Develop a suppression strategy to respond to communities or community infrastructures and threatened and endangered species that are at high risk.

Objective 2.2e – Develop fire management units and wildland fire implementation plans for wildland fire use.

Goal 2.3 – Transportation System (Develop and maintain a transportation system which provides the minimum permanent road access needed to meet resource management objectives. Provide temporary road access that complements the permanent road system for effective resource management. Provide off-road vehicle use in a way that minimizes impacts to other resources. Decommission unneeded roads.

Goal 2.4 – Timber Management (Use timber management, where appropriate, to restore degraded ecosystems, enhance the condition of terrestrial natural communities, and reduce hazardous fuels to reach the desired condition of the forest. Respond to disturbance events (storms, wildfires, disease, or insect attacks, etc.) in a timely manner. Salvage damaged forest resources when compatible with management prescriptions. Provide timber and wood products to help support sustainable local industry and economic interests.

Goal 2.5 Geology and Minerals Management (Provide for mineral prospecting and mineral development while complementing other resource management objectives). Note: Separate consultation for minerals management activities will occur with the Bureau of Land Management (BLM) and the Forest Service for minerals management activities as they come up. The BLM is the permitting agency for minerals actions.

Goal 2.6 – Land Adjustment Program (Consolidate National Forest system lands to improve effectiveness of management and enhance public benefits. Emphasize disposal of isolated tracts of National Forest System lands. Provide public access to National Forest system lands to allow the public to engage in a variety of uses, values, products, and services.)

Objective 2.6a – Acquire lands, or interests in lands, needed to support specific resource management objectives or to consolidate National Forest system ownership patterns. Acquire rights-of-ways or fee simple title in lands, as appropriate, to meet access needs.

Goal 2.7 – Range Management (Within the capability of sustainable ecosystems, provide range forage on open lands in response to demand. Encourage the restoration, establishment, and management of native grass communities on ecologically appropriate sites. Restore and sustain the distribution and quality of native vegetation in range

management units by increasing species diversity and eliminating the spread of non-native species. Manage cool season pastures to provide quality forage that includes a variety of cool season grasses and forbs.)

Goal 2.8 – Recreation Opportunities (Provide a diversity of recreational opportunities and benefits through a variety of settings. Contribute to local, regional, and national economies by providing recreational opportunities in a socially and environmentally acceptable manner.

Goal 2.9 – Visual Management (Maintain or enhance the quality of scenic resources to provide desired landscape character.

Goal 2.10 – Heritage Resources (Support preservation of the cultural heritage of Missouri by identifying, protecting, managing, and interpreting heritage sites in the Forest).

Objective 2.10a – Plan for completion of the Forest heritage resource inventory and evaluations of heritage resources according to provisions set forth in Section 110 (NHPA).

Objective 2.10b – Complete formal determinations of eligibility for evaluated sites.

Goal 2.11 – Wilderness Opportunities (Implement the Wilderness Opportunity Spectrum (WOS) as the primary system for characterizing, locating, and managing the Wilderness resource. Establish management policies that ensure protection of the Wilderness resource while complementing user objectives. Provide for the use of prescribed fire as a management tool to perpetuate fire dependant ecosystems found within the Hercules Glade Wilderness when approved by the Chief of the Forest Service through a change in, or exception to, the National Wilderness Policy.

Chapter 2 of the 2005 Forest Plan contains Forest wide standards and guidelines that apply to all management practices for the entire MTNF. Appendix B of this Biological Opinion includes all of the standards and guidelines for federally listed species and for water quality protection.

The 2005 Forest Plan has nine management area prescriptions (see Table 3) to provide direction to help achieve forest wide goals and objectives. Management areas 1.1 (ecosystem restoration), 1.2 (ecosystem restoration and semi-primitive dispersed recreation), and 2.1 (enhancement of natural communities while providing a variety of goods and services (general forest management)), are all new management prescriptions. Management areas 5.1(wilderness), 6.1 (semi-primitive non-motorized recreation), 6.2 (semi-primitive motorized recreation), 6.3 (candidate rivers), 7.1 (developed recreation areas), and 8.1 (designated special areas other than wilderness) have not changed substantially from the 1986 Plan. Maps of all the management prescription areas are presented in the MTNF's Draft EIS for the 2005 Forest Plan and will not be included here.

Table 3. Management Prescription Assignment in 2005 Forest Plan.

Management Prescription	Total Acres (in 1000's)	Percent of NFS Lands
1.1	376.2	25.1
1.2	62.2	4.2
2.1	669.9	44.8
5.1	64.1	4.3
6.1	73.6	4.9
6.2	196.4	13.1
6.3	17.2	1.2
7.1	5.9	0.4
8.1	30.6	2.0
TOTAL	1496.1	100.0

Description of Management Prescription Areas

The following is a brief description of the Management Prescription Areas excerpted from the 2005 Forest Plan. A complete description can be found in Chapter 3 of the 2005 Forest Plan. The standards and guidelines for each management prescription will not be included here, but can be found in Chapter 3 of the 2005 Forest Plan.

Management prescription (MP) 1.1 emphasizes the restoration of natural communities while providing a roaded natural recreation experience. The **goals of MP 1.1** are to: 1) focus restoration efforts in areas that collectively represent irreplaceable concentrations of distinctive biota, and that represent the highest quality natural communities in Missouri; 2) restore, enhance, and maintain the structure, composition, and function of distinctive terrestrial and aquatic natural communities; 3) restore the ecological role of fire in natural communities; and 4) provide a variety of uses, products and values by managing in support of desired ecological conditions.

Management Prescription 1.2 emphasizes restoration of natural communities while providing semi-primitive motorized dispersed recreation experiences. The **goals of MP 1.2** are to: 1) Focus restoration efforts in areas that collectively represent irreplaceable concentrations of distinctive biota, and that represent the highest quality natural communities in Missouri; 2) Restore, enhance, and maintain the structure, composition, and function of distinctive terrestrial and aquatic natural communities; 3) Restore the ecological role of fire in natural communities; 4) Provide a variety of uses, products, and values by managing in support of desired ecological conditions; and 5) Provide dispersed recreation opportunities emphasizing a semi-primitive motorized setting.

Management Prescription 2.1 emphasizes multiple use resource objectives while allowing for the enhancement of natural communities, improvement of forest health conditions, and roaded natural recreation experiences. The **goals of MP 2.1** are to: 1) Provide a variety of uses, products and values by managing within the capability and resource potential appropriate to natural communities and the landscape; 2) Manage terrestrial and aquatic natural communities to enhance and retain their characteristic ecological elements; and 3) Provide a wide diversity of habitats to meet the needs of plants, fish and wildlife species distributed across the Forest.

Management Prescription 5.1 applies to designated wilderness areas on the MTNF. The **goal of MP 5.1** is to administer Wilderness for use and enjoyment by people in a manner that leaves the areas natural characteristics unimpaired. There are seven designated wilderness areas that

will continue to be managed as such with the implementation of the 2005 Forest Plan: the Hercules Glades (12,314 acres), Bell Mountain (8,777 acres), Piney Creek (7,927 acres), Rock Pile Mountain (4,159 acres), Devils Backbone (6,595 acres), Paddy Creek (6,728 acres), and Irish (16,500 acres).

Management Prescription 6.1 features management of natural vegetative communities under limited investments to provide non-motorized semi-primitive dispersed recreation. The **goals of MP 6.1** are to: 1) Manage natural vegetative communities under limited investment; 2) Provide wildlife habitat diversity common to managed natural communities; 3) Provide dispersed recreation opportunities emphasizing Semi-Primitive Non-motorized Recreation Opportunity Spectrum (ROS) objectives; and 4) Provide for low to moderate production of other resources such as timber products, fish, and wildlife, and forage where they do not substantially limit natural vegetative community management opportunities or dispersed semi-primitive non-motorized recreation objectives.

Management Prescription 6.2 features the management of natural vegetative communities under limited investments to enhance the semi-primitive motorized dispersed recreation experience. The **goals of MP 6.2** are to: 1) Manage natural vegetative communities and their successional stages under limited investment; 2) Provide wildlife habitat diversity common to managed natural communities; 3) Provide dispersed recreation opportunities emphasizing Semi-Primitive ROS objectives; and 4) Provide for low to moderate production of other resources such as timber products, fish and wildlife, and forage where they do not limit natural vegetative community management opportunities or dispersed semi-primitive recreation objectives.

Management Prescription 6.3 provides management for rivers identified as eligible for inclusion in the National Scenic and Recreation River system. The **goal of MP 6.3** is to manage eligible rivers to maintain or enhance their outstandingly remarkable values, free-flowing character, and potential for recommended classification. The Gasconade River, Big Piney River, Black River, Huzzah Creek, North Fork of White River, and St. Francis River all have segments eligible for classification.

Management Prescription 7.1 provides management for the following developed recreation areas: Council Bluff, Sutton Bluff, Big Bay, Shell Knob, Watercress, Markham Springs, Pinewoods, Cobb Ridge, Pine Ridge, Lane Spring, Marble Creek, Loggers Lake, and North Fork. The **goals of MP 7.1** are to: 1) emphasize recreation activities such as camping, picnicking, group activities, and other recreation opportunities; 2) Recognize existing recreation facilities and the future need to provide sites for highly developed recreation intended to serve various user groups; and 3) Encourage development of interpretation, and environmental education opportunities.

Management Prescription 8.1 described a variety of designated “special areas” other than Wilderness. They exist for the protection of unusual environmental, recreational, cultural, or historical resources, and for scientific or educational studies. New areas may be added to this prescription as they are evaluated. The **goals of MP 8.1** are to: 1) Protect and appropriately manage areas of special scientific, biological, historical, ecological, geological, scenic, recreational, and educational significance; 2) Provide low to moderate production of other resources such as timber products, fish, and wildlife, recreation, and forage where they are compatible with “special area” objectives; 3) Maintain or enhance the outstandingly remarkable

values within the Eleven Point Scenic River; and 4) Provide a variety of recreational opportunities with interactions between users ranging from low to high depending on the specific locations and ROS objectives.

Types of Management Proposed to Accomplish Forest Plan Goals and Objectives

Various types of timber or vegetation management activities are proposed to accomplish the above goals and objectives. Table 4 shows the projected vegetation management activities over the 10 year project period. Many of these activities would occur on the same acreage although projects are scattered across the various Ranger Districts.

Table 4. Projected management activities in each MP on the MTNF for decade 1 (U.S. Forest Service 2005b)

Projected Management Activities	Unit	MP1.1 and 1.2 Ecosystem Restoration	MP 2.1 General Forest	MP 5.1 Wilderness	MP 6.1 Semi Primitive Non Motorized	MP 6.2 Semi Primitive Motorized	Total
Commercial Thinning	Acres	33,500	50,000	0	1,200	15,000	99,750
Pre-commercial Thinning and release	Acres	7,500	30,000	0	250	2,400	40,150
Regeneration cut	Acres	34,500	65,000	0	1,200	12,000	112,700
Temporary Roads	Miles	476	805	0	17	189	1,487
Skid Trails (1 mile = .96 acres)	Acres	1,293	2,185	0	46	513	4,037
Non-commercial thinning	Acres	8,388	0	0	0	0	8,388
Red Cedar Reduction	Acres	10,575	2,000	0	0	0	12,575
Prescribed Burning Areas Subject to Multiple Burns	Acres	79,800	15,000	0	0	0	94,800
Hazard Fuels Treatment – Mechanical	Acres	78,404	127,629	21,459	8,037	21,819	257,348
Hazard Fuels Treatment – Prescribed Burning	Acres	156,807	255,257	42,918	32,149	87,275	574,406

Harvest methods that may be used include even-aged systems (i.e., clearcut, seed tree, and shelterwood) and uneven-aged system (i.e., group selection and single tree selection). Intermediate treatments include release treatments, pre-commercial thinning, commercial thinning (including thinning from above, thinning from below, mechanical thinning, restoration thinning, and selection thinning), and improvement cuts. Definitions of these methods can be found in the 2005 Forest Plan Appendix D (U.S. Forest Service 2005b). There are several standards and guidelines in the 2005 Forest Plan that direct how, when and where all of these management activities can occur. For many of these activities temporary roads will be necessary as well as skid trails and landings.

Prescribed fire will be used to accomplish the goals and objectives of the 2005 Forest Plan. Prescribed burning can be broken into discrete units to analyze – fireline construction and pre-treatment work, ignition methods, and mop-up methods. The standards and guidelines in the 2005 Forest Plan direct how, when and where all of these burns can occur. Smoke management

issues are also addressed in the standards and guidelines. In general the smoke management standards and guidelines pertain to smoke sensitive areas (listed species occurrences such as bald eagle nests, Indiana bat hibernacula or roosting sites) or to maintaining air quality standards.

Wildland fires occur on the MTNF. The 2005 Forest Plan contains several standards and guidelines to direct fire suppression activities such as fireline construction, use of fire retardants, and post-fire activities to control erosion and to promote revegetation of burned areas.

Within wilderness areas, fire management activities must be conducted in a manner compatible with overall wilderness management objectives. Preference is 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. Policy on the MTNF is that only leaf rakes and other non-mechanical hand tools (i.e., pulaskis and shovels) will be used during suppression activities in Wilderness areas. The objective is to create a fireline with minimal disturbance of wilderness soil and vegetation, that needs minimal restoration, and that will suppress the fire in a safe and efficient manner. Any exception to the policy must be approved by the Regional Forester.

Pesticides may be used on a case by case basis on the MTNF only if alternative analysis demonstrates that pesticide use is the most effective means to meet overall management objectives. The standards and guidelines in the 2005 Forest Plan directs how, when and where pesticide use can occur.

Range management will occur on the forest. Under the preferred alternative, 17,525 acres will be available for livestock grazing of up to 19,220 animal unit months annually. Several standards and guidelines in the 2005 Forest Plan will reduce or eliminate livestock impacts in sensitive areas such as riparian management zones (RMZ), water protection zones (WPZ) sinks, springs, fens, and other wetlands. Fertilizers may be used in some cases, but not in RMZ, WPZ, on glades or other natural communities. Haying may also occur on some pastures.

RMZ's and WPZ's have specific standards that prohibit certain activities within those areas. Within RMZ's some of the activities prohibited include: pond fertilization, mechanical constructed firelines for prescribed burns, grazing within 100 feet of streambanks, fertilization, new motorized trails, most timber management, drilling and associated structures, servicing of equipment, and more (see Chapter 2 of the 2005 Forest Plan). Within WPZ's some of the activities prohibited include: fertilization, timber management within 25 feet of stream, servicing of equipment, log landings, new roads, unless no feasible alternative, temporary roads except at designated locations, and more (see Chapter 2 of the 2005 Forest Plan).

The MTNF 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 if 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.

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

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.

Background Information on the MTNF (Environmental Baseline across the Forest)

The existing condition of the MTNF lands are a result of implementation of the 1986 Forest Plan and include all actions taken as a result of site-specific project decisions made prior to completion of this Biological Opinion. The existing condition of MTNF lands in relation to limiting factors for the eleven federally listed species considered in the BA is as follows (U.S. Forest Service 2005a):

- ***Water quality***

Water quality is generally considered good in streams and rivers that dissect MTNF lands (MDC Watershed Assessments for White, North Fork, Eleven Point, Current, Black, Meramec, St. Francis and Big Rivers). Rates of soil loss and sedimentation are relatively low in most Ozark rivers. Point and non-point pollution sources are found primarily on other ownerships. MTNF lands comprise 0.2% to 57% of the 5th level watersheds in which MTNF lands lie.

- ***Conversion of habitat***

Permanent conversion of native habitats to urban/agricultural/industrial land uses still occurs on private lands in and around MTNF. No MTNF lands are converted permanently to urban or industrial uses. Some MTNF lands have been converted from forest cover to food plots, grass fields, or wildlife openings. However, only about 5% of MTNF is in openland habitats, compared to 95% in forest cover of varying successional stages.

- ***Cave disturbance***

Two of the four known Indiana bat caves have been gated and are locked shut during the time the bats are there. Populations of Indiana bats have fluctuated in a similar manner in 3 of the 4 caves (2 gated, 1 not gated) over the past 25 years, indicating that while human disturbance has been eliminated or significantly reduced, other factors may be causing the population fluctuations. The fourth Indiana bat cave was just discovered in 2005. Ungated caves are subject to varying degrees of human entry, from almost none to heavy, depending on their location, ease of access and discovery, entrance configuration, and passage configuration. Several caves are protected by the difficulty of finding them, and the technical difficulties presented in negotiating dangerous passages.

Other than structures to prevent human entry, no physical alteration of caves or cave entrances is done on MTNF. A buffer has been established around each known bat cave within which forest cover is maintained.

- ***Lack fire/woody encroachment***

Currently MTNF uses prescribed fire on about 1% or less of MTNF lands per year. The majority of natural communities on MTNF are fire-adapted, and without fire, many are degraded as woody vegetation increases in density, decreasing the diversity of ground cover. This is particularly the case with glade habitats, such as Bell Mountain Wilderness which is the site for the only known location of Mead's milkweed on the Forest. Lack of fire and increased density of trees is also a problem for Hine's emerald dragonfly which requires open, grassy fens, and for Indiana bat which prefers to forage in forest or woodland with more open understories. The

2005 Forest Plan anticipates prescribed burning would be done on up to about 4% of MTNF acres per year, and would be targeted to areas with a high potential for restoration of natural community diversity and structure.

» ***Non-native invasive species***

There are a number of non-native invasive plant and animal species known to occur on MTNF. Some of these may have impacts on federally listed species. Kudzu and honeysuckle cover dead trees to a point that makes them unacceptable as Indiana bat roost trees. Fescue, multiflora rose, and garlic mustard, among others, crowd out native plants, simplifying ecological systems, and reducing plant hosts for the terrestrial insects eaten by Indiana bats. Feral hogs root and wallow, potentially digging up the three federally listed plants, as well as potentially destroying crayfish burrows which Hine's emerald dragonfly larvae use. Both Asian clams and zebra mussels have been found in the Missouri and Mississippi Rivers and could potentially impact listed mussels.

» ***Climate change***

While the Ozarks climate has appeared to be stable over the past several thousand years, there is speculation that climate changes are responsible for the warming of interior cave/mine temperatures, leading to reduced suitability for hibernating Indiana bats.

» ***General Forest Conditions***

Between 1977 and 2003, the amount of black and scarlet oak on MTNF has increased by almost 29% to become the most prevalent forest type on MTNF. In the same time period, white oak decreased almost 61% to less than 10% of MTNF. The amount of sawtimber on MTNF has increased about 39% from 1977 to 2003. The density of trees across the Forest has also dramatically increased, with almost half of the Forest in fully to over-stocked condition in 2003, as compared to about half of the Forest in moderately stocked class in 1977. The age class distribution of MTNF in 2003 shows the majority of the Forest is between 60-90 years old. Since 1975, the MTNF has sold from 15-87 million board feet of timber each year. Most timber sold since about 1984 has been sawtimber.

The MTNF has prescribed burned about 10,000-20,000 acres per year primarily for hazardous fuel reduction and wildlife habitat improvement. The average size of a prescribed burn unit has increased over the past 10 years, and less fireline is being constructed as roads, trails, drainages, and other natural fuel breaks are being used as firelines.

The transportation system on the MTNF is primarily in place, and the MTNF manages about 2,366 miles of National Forest system roads, most of which are gravel or dirt surfaced. Roads are maintained or reconstructed as needed, and as budgets allow.

Chapter 3 of the Draft Environmental Impact Statement (U.S. Forest Service 2005c) further describes the current condition on the MTNF.

As the management activities are likely to occur within the MTNF boundaries, we anticipate all areas within MTNF to be directly or indirectly impacted by Forest Service actions. The action area for this project includes the entire 29 county area that the MTNF resides in. The areas within the 29 counties that the MTNF resides in could be affected through smoke, noise from timber activities, and watershed effects.

TIERED CONSULATION APPROACH

To assess the landscape effects of the proposed actions and to facilitate the MTNF's section 7(a)(2) responsibilities, a tiered programmatic consultation approach will be implemented. The MTNF and the Service have successfully utilized a "Tiered" consultation approach for the past five years under the 1999 Programmatic Biological Opinion. The Service anticipates continuing this same approach. The Tier 1 level is the review of how the overall goals and prescribed management in the 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 MTNF will utilize to implement the plan on listed species. This programmatic biological opinion constitutes the Tier 1 level review.

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

- Site-specific projects should be planned to incorporate all applicable standards and guidelines identified in the 2005 Forest Plan and all of the terms and conditions associated with the reasonable and prudent measures outlined in this opinion.

- 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 should clearly describe the proposed action and analyze the site-specific effects of the project to the listed species that may be affected by the project.

- All site-specific biological assessments should contain a statement that identifies the specific standards and guidelines and terms and conditions that are being implemented for the listed species (this is especially important for the Indiana bat) and also a statement of compliance 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).

- In the site-specific biological assessment, 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 MTNF for each site-specific project. 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.

Mead's Milkweed (*Asclepias meadii*)

STATUS OF THE SPECIES

Species Description and Life History

Mead's milkweed is a long-lived tallgrass prairie species belonging to the milkweed family (Asclepidaceae). It is a perennial, rhizomatous herb that occurs in hay meadows, glades, or barrens (U.S. Fish and Wildlife Service (U.S.F.W.S.) 2003). Mead's milkweed has been observed in prairies with up to 11 other native species of milkweeds. This species can be distinguished from other milkweeds by a combination of smooth "stalkless" opposite leaves with a herringbone venation and a single nodding umbel consisting of fragrant greenish-cream flowers.

Mead's milkweed begins its seasonal growth in mid to late April. It has a slender unbranched smooth stalk, 8-16 inches tall, with a whitish waxy covering. The leaves are opposite, broadly ovate, 2-3 inches long, 3/8 – 2 inches wide, hairless, with a whitish waxy coating. The single umbel has 6-15 greenish-cream colored flowers that begin showing in late May and early June. If reproduction is successful, the young green fruit pods appear by late June and grow to approximately 1.5-4 inches by late August or early September. Upon maturity the pods darken, and the seeds within are mature by mid-October (U.S. Fish and Wildlife Service 2003).

Mead's milkweed has low reproductive rates, requiring 15 years or more for maturation from seed to flowering plant (Bowles et al 2001). The species longevity is an important life history strategy that probably allows its sustainability in areas that are repeatedly mowed before the fruits have reached maturity (Bowles et al 1998, Tecic et al 1998). Mead's milkweed also produces ramets from its elongated tuber-like rootstock and from rhizomes (Hayworth et al 2001). These clones rarely produce seed, making these clonal populations vulnerable to extinction (Tecic et al 1998, Hayworth et al 2001, Bowles et al 2001).

Status and Distribution

Mead's milkweed was federally listed as a threatened species on September 1, 1988 (53 CFR 170: 33992-33995). The historical range of the species included the entire eastern tallgrass prairie region of the central United States from Kansas through Missouri, and Illinois to southern Iowa, southwest Wisconsin, and northwest Indiana (U.S.F.W.S. 2003). Mead's milkweed no longer occurs in Wisconsin and Indiana. Local extirpations have occurred throughout the historic range and the species currently exists in 171 sites in 34 counties in eastern Kansas, Missouri, south-central Iowa, and southern Illinois (Table 5). Rankings of these populations are based on habitat quality and population size and vigor – "A" being highly quality habitats and populations of 200 or more ramets exhibiting sufficient recruitment to sustain that population, "D" being poor quality habitat with small populations of less than 25 ramets or less than 100 ramets that does not produce or release viable seeds over a period of five years.

Table 5. 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 MTNF is in the Ozark-St. Francois Mountains 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

The majority of Mead's milkweed populations in Missouri are found on private lands (Horner 2001 as cited in U.S. Fish and Wildlife Service 2003). In a recent survey of Missouri prairie sites, only 5 of 35 sites visited had populations of Mead's milkweed (Eulinger 2005 personal communication). Of the five sites that had populations of Mead's milkweed, there were 149 sterile plants found at all five sites, 21 flowering at 4 sites, and 5 with fruit at two sites. The long term viability of these populations is unknown.

In summary, only 15 of 171 populations of Mead's milkweed across the range of the species are in good to high quality habitat, with good or better viability. The majority of the known populations is of low viability and/or is on poor quality habitats.

Threats

The destruction and alteration of tallgrass prairie due to intense agricultural use, urban growth and development, recreational use of sites and hay mowing that disrupts the species' sexual reproductive cycle continue to threaten Mead's milkweed (U.S. Fish and Wildlife Service 2003). Other threats include predation, pathogens, herbivory (Grman and Alexander 2005), sexual

incompatibility, and stochastic events can also threaten smaller populations. Small populations also may not be able to attract pollinators (Grman and Alexander 2005, MDC 2000). The elimination or decline in the use of fire to maintain suitable habitat also threatens the species.

The majority of Mead's milkweed populations are on private lands. Mead's milkweed populations are protected only on public lands in Missouri. Less than half of Missouri's Mead's milkweed populations are in public ownership or otherwise protected by private conservation groups. Kansas does not offer any legal protection for Mead's milkweed and only four populations are on public land or otherwise protected by conservation groups. In Iowa, only two Mead's milkweed sites are in public ownership and are being managed, though all Iowa populations are protected by law. The other Iowa sites are private hay meadows, pastures, and another is a right-of –way of an abandoned railroad prairie threatened by adjacent land use. Mead's milkweed is also only protected on public land in Illinois and its removal from any site requires permission of the landowner.

Recovery goals for the Mead's milkweed are to: 1) recover extant populations to viable population levels throughout the species range, and 2) introduce new populations and restore to viable levels in regions where populations have been extirpated (U.S. Fish and Wildlife Service 2003). The recovery criteria for Mead's milkweed are as follows: 1) Twenty one populations are distributed across plant communities and physiographic regions within the historic range of the species; 2) each of these 21 populations are highly viable; and 3) monitoring data indicates that these populations have had a stable or increasing trend for 15 years.

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, Grman and Alexander 2005).

ENVIRONMENTAL BASELINE

Status of the Species within the Action Area

Mead's milkweed has only been found in one location on the MTNF. The site is a large rhyolite glade within the Bell Mountain Wilderness in Iron County. This area is a part of the Ozark-St. Francois Mountain physiographic region. The Bell Mountain Wilderness is part of the St. Francois Mountains, one of the oldest landforms in North America. The Wilderness is 8,777 acres and was designated on December 12, 1980.

The area is within the oak-hickory-pine ecosystem (U.S. Forest Service 2005b). Oak and hickory are the predominant tree species within some areas of natural oak-pine and some shortleaf pine plantations. Upland brush and red cedar make up a small portion of the vegetative component. Blackjack oak, winged elm, hickories, sumac, and natural grasses are found on the rock exposures. Lichens abound on the exposed surface rock.

The actual Mead's milkweed site is about 10' x 10' in size and contained 24 ramets in 2001 and 2004. The site is characterized by having rocky ledges on one side and encroaching red cedar on the other side. Sumac stems are present throughout the area and the ground cover is a mat of little bluestem and sedges (U.S. Forest Service 2005a). Using the Determination of Population Viability Index (PVI) shown on Table 6, page 22 of the 2003 Mead's Milkweed Recovery Plan,

the MTNF has determined that the Bell Mountain population has a PVI of 0.4 (U.S. Forest Service 2005a) (see Table 6). This is considered to be of low viability.

Table 6. Population Viability of Mead's Milkweed at the Bell Mountain Wilderness Site on the Mark Twain National Forest. PVI = 9/21 = 0.4 (Low viability defined as less than 0.50).

Variable	Current Condition	Ranking
A. Population size	24 mature ramets	1
B. Population growth trend	Increase in # from 1993 to 2001; no flowering	2
C. Effective population size/ number of genotypes	24 mature ramets	1
D. Habitat size	Large glade complex, but <1 hectare inhabited	0
E. Habitat condition/ successional stage	Site in wilderness area – no human (management) disturbance for decades	2
F. Protection status	On federal land	3
G. Management condition	In wilderness – no human manipulation – in need of fire and reduction of woody invasion	0
Total		9

Bell Mountain Wilderness is in MP 5.1. Active management for this species is constrained by wilderness legislation authorizing the Bell Mountain Wilderness designation. The Mead's Milkweed Recovery Plan (U.S. Fish and Wildlife Service 2003) recommends the use of prescribed fire and control of invasive species by fire, herbicides, biological control and manual and mechanical brush removal to manage habitat for Mead's milkweed. To date no management of this population or its surrounding habitat has occurred. This lack of management is limiting the viability of this population.

The MTNF has seen an increase in the number of feral hogs found on the Forest over the past few years, including within the Bell Mountain Wilderness. The MTNF has been cooperating with other agencies to eliminate feral hogs across the Forest, but illegal releases continue to occur across the Ozarks. Herbivory by wildlife has been noted to lower fruit production in Mead's milkweed (Grman and Alexander 2005). Feral hogs could potentially harm or destroy the Mead's milkweed population at this site.

The MTNF has about 38,000 acres of glade habitat that could provide potential habitat for Mead's milkweed. Despite multiple surveys, no other populations of Mead's milkweed have been found outside Bell Mountain Wilderness on the MTNF. In addition to the Bell Mountain population, at least one highly viable population occurs within the action area and five other populations of lesser quality occur within the action area, mostly on state owned land (MDC and Missouri Department of Natural Resources (MoDNR) lands).

The MDC and MoDNR have both managed their lands to maintain or improve glade habitats through prescribed burning, various types of timber harvest, and some herbicide use. The populations on many of these sites appear to be healthy (Paul McKenzie, USFWS personal communication 2005). One of the sites is a highly viable population, as defined by the Recovery Plan. Recreational opportunities also exist on these lands, though recreational damage to the

sites where the species occurs is low. The recovery plan goal for the Ozark-St. Francois Mountains physiographic region is to have one highly viable population.

Previous Biological Opinions for Mead's Milkweed

A search of the Service's Region 3 Section 7 Database show only one biological opinion has been written for the Mead's milkweed. That opinion was the June 23, 1999, "Biological Opinion on the Impacts 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," prepared by the Columbia Missouri Ecological Services Field Office. 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 this population continues to decline. The MTNF has continued to monitor the Bell Mountain Wilderness population and has provided the Service with annual reports.

EFFECTS OF THE ACTION

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 actions that implement the Forest Plan will affect the listed species.

Direct Effects and Indirect Effects

The overall goals and objectives of the 2005 Forest Plan are to promote ecosystem health and sustainability and to provide a variety of uses, values, products and services to the public. The only known Mead's milkweed population on the MTNF is located in a designated wilderness area (Bell Mountain Wilderness). All wilderness areas are managed under MP 5.1. In general, vegetation management will not occur in wilderness areas. Trails in this wilderness area will continue to be maintained. The following standards are included in MP 5.1:

> When approved by the Regional Forester through a change in, or exception to, National Wilderness Policy, prescribed fire will be used where it can be determined that a certain frequency of fire is essential to air, maintain, or restore natural plant communities or threatened and endangered plant species.
>
> Projects involving manipulation of vegetative cover shall be approved by the Chief of the Forest Service on a project-by-project basis. All projects must have, as their objective, enhancement of the Wilderness resource. To qualify for approval habitat manipulation projects must satisfy [the following]:
>
> - The project can be accomplished with complete assurance that damage to the watershed or Wilderness values of serious or lasting nature will not develop.

- There is reasonable assurance that the project will accomplish the desired objectives.
- The condition to be remedied is a result of man's influence.
- The project will promote the perpetuation of a threatened or endangered species.

These standards only direct site specific projects that may be proposed under the 2005 Forest Plan. The MNTF is not currently proposing to conduct management activities within the Bell Mountain or any other Wilderness area.

Over the project period, the MTNF proposes to restore or maintain 140 acres of glade habitat in the St. Francis Knobs and Basins, some of which may provide potential habitat for Mead's milkweed. These glade areas on the Forest (not in the Wilderness areas), which are currently unoccupied, but which may provide potential habitat could be managed with prescribed fire or other mechanical means which follow the standards and guidelines as outlined in the Forest Plan (i.e., all prescribed burning would be conducted during the plants' dormant season).

Given that there are standards that could allow management of the Bell Mountain Wilderness (note: the MTNF is not currently proposing to conduct prescribed burning or any other management in the Bells Mountain Wilderness to benefit the Mead's milkweed) and given that other potential habitat can be managed to create suitable conditions for Mead's milkweed, the overall Forest wide goals and objective's and MP 5.1 can benefit Mead's milkweed habitat if site specific projects were implemented.

Per their preferred alternative, the only management activity that will occur in the Bells Mountain Wilderness is recreation management (trails). Recreational use such as hiking, horseback riding, hunting and camping occur in Bell Mountain Wilderness (U.S. Forest Service 2005a). Trampling could occur, but is expected to be minimal given that the distance to the Mead's milkweed site is ¾ mile from the nearest trailhead and also approximately 100 feet downslope from the nearest trail. Past observations corroborate this belief as recreational use levels in this wilderness area are low (U.S. Forest Service 2005a).

Timber management, motorized vehicles, developed facilities, herbicide use, and most special uses are not permitted in the wilderness areas. The lack of prescribed fires within the Bell Mountain Wilderness is the most significant threat to the viability of this population. 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, Grman and Alexander 2005).

If an arson fire, accidental fire or wildland fire occurred during the growing season, this population could be destroyed or damaged. If such a fire started in the non-growing season, the population might benefit from the fire. However, fires that start in wilderness areas are typically suppressed. The policy on the MTNF for suppressing a wildfire in any Wilderness is to only use leaf rakes and other non-mechanical hand tools. Leaf rakes are used to rake leaf and needle litter away from the fire and down to mineral soil to create a fireline that is devoid of fuel. Pulaski's and/or shovels may be used to cut small branches or roots or to help move large logs out of the fireline. Wherever possible, the fireline is located to take advantage of natural fuel breaks, such as rocky outcrops, drainages, or established hiking trails, and to avoid areas where large, downed

woody material is abundant. Given that a hiking trail is near the Mead's milkweed site, it is likely that the trail would be used as a fireline. Fire fighters would be made aware of the site and depending on the season the wildfire occurred, appropriate action to protect (or benefit) the site would be taken (Jody Eberly, MTNF, personal communication 2005).

Species Response to the Proposed Action

As noted above, this population is at a low viability level. Without the use of prescribed fires or other woody vegetation management within this wilderness area, woody vegetation will eventually take over the site, shading over the Mead's milkweed. Unless these management actions occur, it is likely that this species will decline and eventually disappear from the Bell Mountain Wilderness.

The Bell Mountain Wilderness Mead's milkweed population represents 0.67% of the total known sites for the species. There are six other Mead's milkweed populations within the Ozark-St. Francois Mountain physiographic region – all adjacent to the MTNF. At least one other population in this region is of high viability. The recovery plan goal for the Ozark-St. Francois Mountains physiographic region is to have one highly viable population. Therefore, the loss of the Bell Mountain Wilderness Mead's milkweed will not appreciably hinder the recovery of the species.

Cumulative Effects

Cumulative effects include the effects of State, tribal, local, or private actions that are reasonably certain to occur within 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.

The other populations of Mead's milkweed that occur within the action area, but not on the MTNF, are all on lands owned by the state of Missouri (Missouri Department of Conservation and Missouri Department of Natural Resources). These agencies have both managed their lands to maintain or improve glade habitats through prescribed burning, various types of timber harvest, and some herbicide use. Populations of Mead's milkweed continue to persist in these areas. One site is classified in the Recovery Plan as highly viable. Recreational opportunities also exist on these lands but use levels and damage levels are low. These management activities are reasonably certain to continue. Prescribed burning conducted in the appropriate season will continue to benefit the populations.

State, Federal, and local road maintenance, reconstruction, and relocation projects occur regularly across the state. Any that crossed glade habitat have the potential to impact known or unknown populations. We know of no such projects that are scheduled to occur in or near occupied habitat, therefore any effects are not reasonably certain to occur.

Thousands of private landowners reside throughout the action area. There are no known Mead's milkweed populations on private land in this area; however, not all areas have been searched.

CONCLUSION

The 2005 Forest Plan allows the flexibility to manage habitat for Mead's milkweed, though approval from the Regional Forester or Chief of the Forest Service would be necessary for active management in the Bell Mountain Wilderness (the only known location of the species on the MTNF). Without active management the population will continue to decline and will eventually disappear from the site. All populations of a declining species are important, however the recovery team has determined that one highly viable population in the Ozark-St. Francois Mountains is necessary for the recovery of the species. Therefore, if this population did disappear completely from the MTNF, recovery would not be appreciably hindered.

After reviewing the current status of Mead's milkweed, the environmental baseline for the action area, the effects of the proposed Forest Plan Revision and the cumulative effects, it is the Service's biological opinion that the MTNF Forest Plan Revision, 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. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

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 MTNF implement the following conservation measures to benefit Mead's milkweed:

1. In order to minimize adverse effects from the current **lack of needed management** and to implement recovery actions from the Mead's Milkweed Recovery Plan (Recovery Action 2.2), develop a management strategy to perpetuate the glade ecosystem and obtain approval from the Regional Forester and/or Chief of the Forest Service to conduct prescribed fires on a regular basis and manual woody stem removal (if necessary) on the portion of the Bell Mountain Wilderness which provides habitat for Mead's milkweed.
2. In order to protect the Bell Mountain Wilderness Mead's milkweed population; continue to cooperate with the Missouri Department of Conservation (MDC) and Animal Plant and Health Inspection Service (APHIS) - Wildlife Services, to reduce or eliminate feral hog populations in this area.

3. In order to maintain current information on this species and to implement recovery action 4.5, conduct annual surveys in the wilderness area and on other suitable glades (especially before site specific projects are implemented) in consultation with the Service and MDC.
4. To develop more information on the species, conduct demographic life history studies on the population to determine the degree of sexual reproduction; the percent of flower, pod and seed production, seedling establishment; and the longevity of plants through time. These studies could be done cooperatively between the MDC, Missouri Department of Natural Resources, the Service, and the Morton Arboretum as a part of a larger project.
5. An annual report of the outcome of all management and research activities conducted for the Mead's milkweed within the Bell Mountain Wilderness or any other populations that may be found on the MTNF, should be submitted to the Service by December 31 of each year.

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.

Indiana Bat (*Myotis sodalis*)

STATUS OF THE SPECIES

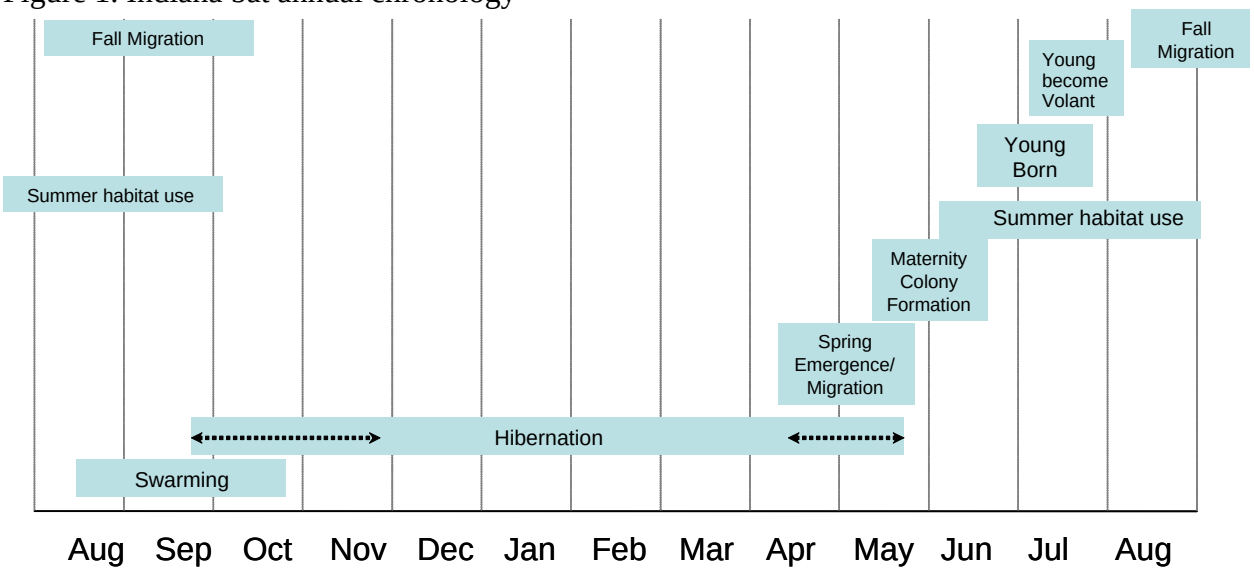
Species / Critical Habitat Description and Life History

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).

Critical habitat has been designated at 13 Indiana bat hibernacula in six states. At the time of designation, those hibernacula harbored nearly 90 percent of the known population.

There is still much to learn about the Indiana bat life history. Figure 1 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 1. 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 last 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 (based on other species of temperate zone bats (Gustafson 1975; Schowalter et al 1979; Racey and Entwistle 2003; Barclay and Harder 2003) sexually mature until the summer after their birth. 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 hectares (ha)(415 acres) in their Kentucky project area and within 2.4 kilometers (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 568ha (0.99 to 1,403 acres) and the maximum linear distance traveled was 4.15km (2.6 miles) with a mean maximum linear distance of 2.08 ± 0.66km (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 ± 1424 ha (3,914 ± 3,518 acres)(90% MCP), and the maximum linear distance traveled from the point of capture was 6.4km (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 volumes 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 deceased 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 most 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, personal communication 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 1991). 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 Missouri. 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). 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, 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, 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 (U.S. Forest Service 2005 (BA)); 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 2002), an old church attic (Butchkoski and Hassinger 2002), and in utility poles (Rick Hansen, USFWS, personal communication 2005). Habitats surrounding known maternity colony areas vary from riparian, bottomland, and wetland forests (Humphrey et al. 1997; Cope et al. 1978l Kurta et al. 1993,

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). Although the majority of temperate zone bats Indiana bats are likely to have singletons, Sybill Amelon (North Central Research Station, personal communication 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. 1991; 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. 1991; 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 environs, Indiana bats may frequently use other roost trees to locate future roost sites for when their existing roosting trees become unsuitable.

Gardner et al. (1991) and Sparks et al (*in* press) 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. 1997; 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 (300km) 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 2002a). 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 flood plain, 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). They do not forage within the canopy, but forage around the tree canopy.

Maintaining or creating sources of water (when necessary) for Indiana bats is important (Krusic and Mighton 2002). Approximately 20-25% of water used by bats each day comes from drinking (Kurta et al 1989, 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 U.S. 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 7).

Table 7. 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

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.

Missouri

Indiana bats hibernate in Missouri in both caves and mines. The population of Missouri's Priority one and two hibernacula continues to decline for unknown reasons, though the rate of decline has slowed in recent years (Peggy Horner, MDC personal communication 2005). The total documented (or estimated for Pilot Knob Mine) population is currently 65,104 Indiana bats (see Table 8) in 67 known hibernacula (Clawson 2002).

Table 8. Missouri Priority One and Two Indiana bat hibernating populations.

YEAR	POPULATION
1999	74,750
2001	72,983
2003	66,805
2005	65,104

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. Recent conservation efforts may be contributing to this population growth. 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. More research is needed to determine what type of disturbance near occupied roost trees causes arousal.

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.

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, personal communication 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), personal communication October 1996 as cited in USFWS 1999). 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).

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 just 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. 1984; Myers 1964).

Suspected Causes

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. Forests in northern portions of the range may be denser than they were historically, although the number of acres of forested lands may be fewer.

Indiana bats are loyal to their summer maternity areas. Projects that remove all 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 Biological Opinions for Indiana Bats Across the Range of the Species

A summary of the consultations (and a Habitat Conservation Plan) follows. Appendix C of this programmatic biological opinion is a table of previous formal consultations on Indiana bats range wide.

All previously issued Service biological opinions involving the Indiana bat have been non-jeopardy. These formal consultations have involved: the Forest Service for activities implemented under various different Land and Resource Management Plans on different National Forests in the eastern United States; the Federal Highway Administration for various transportation projects; the U.S. Army Corps of Engineers (Corps) for various water projects; the National Park Service for various projects; and 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.

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. Consequently, the Service has prepared non-jeopardy biological opinions and issued incidental take statements for at least fifteen different National Forests throughout the species' range. Some biological opinions cover more than one National Forest. We have yet to confirm the loss of a maternity colony on these National Forests. The primary reason for this is that the proposed conservation measures by the Forest Service and the required Reasonable and Prudent Measures identified in the Incidental Take Statement include measures to avoid direct impacts to summering bats. Specifically, these measures: 1) ensure an abundance of available remaining Indiana bat roosting and foraging habitat on National Forests; and 2) ensure persistence of any known or newly discovered maternity colonies to the maximum extent practicable.

Incidental take exempted on National Forests was monitored or tracked by acres of habitat loss or alteration. Over 95% of these acres are affected by varying degrees of temporary loss (short-term and long-term) as a result of timber management activities.

None of the incidental take statements referenced above has resulted in an appreciable reduction in the numbers of Indiana bats because of the nature of the loss and the conservation measures implemented in conjunction with the proposed action.

Other Federal Agencies or Non-federal Entity

Several incidental take statements (See Appendix C) have been issued to other federal agencies and a non-federal entity (an HCP incidental take permit), respectively. Some of these projects actually involved impacts to known maternity colonies or suitable maternity habitat. For these projects (with the exception of Fort Knox), conservation measures, included as part of the proposed action, were designed to minimize impacts to the colony with the goal of ensuring persistence of the colony after implementation of the project. These measures included: seasonal clearing restrictions to avoid disturbing female Indiana bats and young; protection of all known primary and alternate roost trees with an appropriate buffer; 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 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. There are three examples in Indiana (Camp Atterbury, Newport Military Installation, and Indianapolis Airport) where monitoring has confirmed that the colony persisted through the life of the project and continues to exist today. However the full extent of the anticipated impacts may not yet have occurred and overall population trends are difficult to discern.

The Fort Knox biological opinion [1999] did authorize the loss of two potential maternity colonies and individual Indiana bats. The biological opinion did not specify whether the "take" consisted of loss of the colonies or take in the form of harm and harassment. In subsequent surveys after the biological opinion was issued, maternity activity was confirmed in two different areas at Fort Knox.

As noted previously, a Programmatic Biological Opinion was issued by the FWS to the MTNF in 1999, regarding the impacts of forest management on listed species including the Indiana bat. The incidental take statement in that biological opinion anticipated the annual manipulation of 38,375 acres per year. From 1999 to 2004 the MTNF had a maximum of 230,250 acres that could have been manipulated under the 1999 Programmatic Biological Opinion. Actual acres reported were 150,755 (65 percent of the total anticipated extent of incidental take)(see Table BA-1 "Indiana bat [incidental] take acres baseline 1999-2004" in the Biological Assessment for the 2005 Forest Plan).

ENVIRONMENTAL BASELINE

Across Missouri (not just the 29 county area), the forested land area has steadily increased since 1972 and standing volume has increased since 1947 (Moser et al. 2005). In Missouri, the net growth of growing stock on Missouri's timberlands has increased on average, 629.4 million cubic feet per year from 1989 to 1999-2003. Average annual removals of growing stock on timberland across Missouri totaled 118.6 million cubic feet per year in the same period. Removals from private lands totaled 100.0 million cubic feet per year (Moser et al. 2005). Moser et al. (2005) also determined that the average annual mortality of all growing stock on timberlands in Missouri during the same period was 81.8 million cubic feet. Average annual mortality on Missouri's public lands was 19.5 percent of the total or 15.9 million cubic feet per year.

Moser et al. (2005) also cites a variety of factors affecting forested land across Missouri. Tornados, hail and straight-line winds damage thousands of acres of land in Missouri each year, including MTNF lands. Drought is another factor stressing trees in Missouri. Insects and diseases also affect Missouri's timberlands. Interestingly, Moser et al. (2005), reports that lepidopteran populations were very low in 2003. Indiana bats prey on lepidopterans.

Status of the Species within the Action Area

Hibernating populations

There is no designated critical habitat for the Indiana bat on the MTNF. There is no Priority 1 or 2 hibernacula on the MTNF.

There are four known Priority 3 Indiana bat hibernacula on the MTNF (White's Creek Cave, Cave Hollow Cave, Davis # 2 Cave, and Knife Cave). The Indiana bat populations within White's Creek Cave, Cave Hollow Cave, Davis # 2 Cave, have fluctuated ever since their discovery (see Table 9). The hibernating population in Knife Cave was discovered in 2005. These hibernacula on the MTNF harbor populations of approximately 275-400 Indiana bats. This represents 4 to 6 percent of Missouri's total known wintering population and about 0.07to 0.1% of the range wide winter population. The BA notes one other cave on the Forest as having Indiana bats present (Hanley Cave). Hanley Cave had two hibernating Indiana bats in 1979. Indiana bats have not been found in that cave in more recent surveys.

There are five other Indiana bat hibernacula within the proclamation boundary of the MTNF. These hibernacula are located on Fort Leonard Wood, MDC lands, U.S. Fish and Wildlife

Service lands, and National Park Service lands. There are 13 other Indiana bat hibernacula within five miles of National Forest land.

Table 9. Hibernating Indiana bat populations on the Mark Twain National Forest

Year Surveyed	White's Creek Cave (Oregon County)	Cave Hollow Cave (Iron County)	Davis #2 Cave (Pulaski County)	Knife Cave (Pulaski County)
1988		250		
1990	39			
1996			37	
1997			20	
1998	21	79		
2001	1	5		
2004	33	150	26	
2005	Knife Cave hibernacula discovered in 2005			67

Summer populations

Mist net and Anabat surveys have been conducted on the MTNF since 1997. A summary of data collected between 1997 and 2004 indicates that a dozen Indiana bats had been captured on or near the MTNF, with five actually captured on the Forest. The five captures on the MTNF were all in 2003 or 2004. Other than at cave entrances (i.e., emergence or fall swarming captures), no other Indiana bats were captured on the Forest prior to 2003. These surveys represented over 400 mist net sites and over 2,700 hours of mist netting, and over 400 Anabat sites and over 4,400 hours of Anabat detection. This equates to about 540 hours of effort to capture one Indiana bat. This capture rate likely indicates that Indiana bats are not abundant (or not present) in the areas surveyed.

Of the five Indiana bats captured between 1997 and 2004, three were males and two were females (one pregnant and the other post-lactating). All of these Indiana bats were captured in the Salem and Potosi/Fredericktown Ranger Districts in east-central Missouri. The Poplar Bluff Ranger District is also used by a maternity colony (the females were not captured on MTNF lands). Four of these bats were radio-tracked and some information was gained about their roost trees and foraging area.

Reproduction was not documented on the MTNF until 2003 when a pregnant female was captured on the Potosi/Fredericktown Ranger District. This pregnant female (captured in 2003) was not radio tracked because she was carrying twins and very near to parturition (Sybill Amelon, North Central Research Station, personal communication 2005). Further mist netting in the same area on the Forest where this female was captured in, has not lead to the capture of any more Indiana bats. A maternity colony may be roosting and foraging on adjacent private and/or state land. In July 2004, one post lactating female was captured on the Salem Ranger District. This female was fitted with a radio transmitter but her roost trees were never located. This female may be part of the maternity colony (colonies) found in 2005 in the same area.

In May 2004, two pregnant Indiana bats were captured on U.S. Army Corps of Engineers lands, adjacent to the MTNF. These Indiana bats were radio tracked to a roost tree on the Poplar Bluff Ranger District. Exit counts at this roost documented a maximum of 30 bats emerging on June 2, 2004.

Surveys continued on the MTNF in 2005 (just prior to and during this consultation period). Since April 2005, sixteen Indiana bats have been captured on the MTNF. These captures include the capture of 7 male Indiana bats that were captured in April 2005 at the entrance of Knife Cave and four males that were captured at the entrance of Cave Hollow Cave. Two reproductively active females and one male were captured over a pond on the Salem Ranger District on May 24, 2005. Based on the radio tracking of the two females, it is likely that two maternity colonies may be present in this area – since aside from the capture of the two females at the same pond, these females never interacted (i.e., never used roost trees in common and foraging areas did not overlap (Sybill Amelon, personal communication 2005). In June, one male was captured on the Houston/Rolla/Cedar Creek Ranger District and another male was captured in July on the Salem Ranger District. See the description below for more information regarding the habitat these Indiana bats are using.

The capture and radio tracking effort by the Forest Service has provided important information regarding summer habitat use by both male and female Indiana bats on the MTNF.

Maternity Roost Trees – Until May, 2005, the only maternity roost tree discovered to date on MTNF was a 14-16" dbh shortleaf pine snag about 70 feet tall, and is located in a canopy gap on a slight northeast facing slope. This was the roost tree of the maternity colony discovered in 2004 on the Poplar Bluff Ranger District. The tree has almost no bark left, and the bats were under a slab of bark about 2/3 from the base of the tree. The stand containing this roost tree was commercially thinned in 1992, and has a moderate stocking of relatively large hardwood and shortleaf pine trees. This stand is composed of relatively large trees, and the surrounding area contains an abundance of large snags in varying stages of decay (personal observations Jody Eberly and Theresa Davidson 6/9/04). Photos of this area are included the BA, Appendix F.

During the week of May 23, 2005, five maternity roost trees were located on the Salem and Potosi Districts. Four of these roosts are on MTNF lands, and one is on private land. All five trees are dead snags, ranging in size from about 9"-20" dbh. Three are shortleaf pine, one is a post oak and one is an oak (species not noted). One is located in a 10 year old seedtree harvest, and the one on private land is located in a recently cutover area. The other three trees are located in mature forest of moderate to dense canopy, but all the trees are exposed to the sun. All of these trees are currently located in the "Area of Influence" designated (5 mile area around hibernacula as defined by the MP 3.5 of the old Forest Plan) for the Cave Hollow Cave hibernaculum.

Each of the radioed females has used one tree for several consecutive nights (each female used a different tree). Each radioed female left that tree on Friday night (when it rained) and used two different roost trees. An exit count at one of the alternate trees found nine bats emerging at dusk. Both females were found back at their original trees the next night. One female has also used a third roost tree for at least one night.

The behavior and life history requirements of Indiana bats using maternity colonies on MTNF do not appear to be adversely impacted by anthropomorphic noise. In fact, anecdotal information indicates that maternity colonies may be tolerant of noise and other disturbances. For instance, the area in which the Salem Ranger District maternity trees are sited is one of the most intensively managed areas of MTNF for wood products, as well as being located within the Viburnum Trend, the largest lead-producing area in the U.S. There is one active timber sale unit

that is just ¾ mile from one of the maternity roost trees. Within ¾ mile of at least one of the maternity roost trees are two active lead mines, tailings ponds, air shafts for the mines, the sewage disposal pond for the town of Bixby, a large power line, a sawmill, and two state highways. The noise from the vent shaft and mine at the primary roost tree for female #1257 is extremely loud (Sybill Amelon, pers. comm. 6/6/05 to Jody Eberly as noted in the BA).

Bat surveys (mist net and Anabat) across the Forest since 1997 during the appropriate season (May 15-August 15) have not documented maternity colonies on the Ava/Cassville/Willow Springs Ranger District, the Eleven Point Ranger District, or the Houston/Rolla/Cedar Creek Ranger Districts.

Male Roost Trees - Ten male roost trees were discovered by radio-tracking captured males in the summer of 2004. These trees were all dead oak or shortleaf pine snags, with varying amounts of flaking bark, and ranged from 6" dbh to about 14" dbh. One of these trees had no bark, and the bat was roosting in a crack in the tree bole. Some of these trees were used by a single bat more than once. Almost all male roost trees were within 1 mile of their capture site, with one roost tree being about 3.5 miles from the capture site. All male roost trees were on the Salem and Potosi/Fredericktown Districts

One of the two males radio-tracked in April 2005 at the entrance of Knife Cave was tracked to five different roost trees (4 shortleaf pine snags and 1 black oak/blackjack oak hybrid snag). Three pine snags were located in a small group in a dense pine plantation (basal area about 200 sq ft/acre) and were within about 200 feet of each other. These trees were also within about 100 yards of a constructed wildlife waterhole on National Forest lands. The fourth pine snag was about 150 yards from the other three. The dead oak roost tree was located about 0.12 miles from the others. All of the roost trees were within about ½ -3/4 mile from Knife Cave. The snags ranged in size from 10" dbh to 16" dbh and from 30 feet to about 70 feet tall. The oak snag was located on private land which had been "high-graded" (all the good timber trees had been removed in a harvest operation) in the past, and the bat had to cross an open area of about 30-40 yards to reach the snag.

Seven male roost trees were located on the Salem and Potosi Districts by the end of May 2005. One male bat was tracked to 5 separate roost trees, all within 0.3 miles of each other, and within 1.3 miles of Cave Hollow Cave. This bat foraged along a nearby Forest Road. His roost trees were two 4" maple snags in year old shelterwood harvest units, two 8" pine snags, and one 10" pine snag. The other male bat was initially tracked to 2 roost trees. The two trees (12" and 20" oak snags) are about 0.9 miles apart, about 4 miles from Cave Hollow Cave, and about 0.8 miles from the capture pond. This male was tracked to one additional roost tree on June 1. It is a 7" red maple snag in an intermittent stream drainage located on private lands. This male stayed in this tree for three days.

Night Roosts – No Indiana bat night roosts have been documented on MTNF. There is an abundant supply of potential night roosting trees on MTNF. However, artificial structures that could be used by bats for night roosting are limited. MTNF has some old buildings on lands acquired from private owners, but has no concrete bridges. There are a few low water crossings constructed with one or more box culverts, but these are low enough that they would present a flooding hazard and are not considered suitable night roosts.

Foraging Habitat – The female bats in the Poplar Bluff maternity colony foraged along a riparian corridor about 1 mile north of the MTNF roost tree. There were several other roost trees located within this corridor (off National Forest lands). The corridor consisted of a permanent stream with vegetation consisting mainly of forest and open grasslands along the stream. The Salem female foraged primarily in upland forest on both private and National Forest lands. This female also foraged over a privately owned mine tailings pond, and other private lands in the vicinity of a lead recycling facility (Sarah Bradley, pers. comm. 2004). Appendix F of the BA has photographs of these areas.

The two females captured in May 2005 foraged in the general vicinity of their roost trees, but specific data is still being analyzed.

The three males tracked in summer 2004 foraged in a variety of locations. One male foraged primarily over the nearby stream and occasionally up and down the Forest Road through the middle of the pine plantation in which it was roosting (Lynda Mills, pers. comm. 2004). This male stayed within approximately 1 mile of its capture site. One male foraged primarily in upland forest near his capture site, on private forested lands nearby, and over an old tailings pond about 3.5 miles from his capture site. He also foraged in the same general area as the Salem female described above, including around the lead recycling facility (Sarah Bradley, pers. comm. 2004). The third male foraged primarily over NFS lands in upland forest and over old fields on both NFS and private lands (Sarah Bradley, pers. comm. 2004).

One of the males radio-tracked from Knife Cave foraged in an upland drainage for much of the first night. No further foraging information was collected on this bat.

One of the males tracked in May 2005, foraged along a Forest Road about 0.3-0.6 miles from the roost trees. No foraging information was obtained on the remaining male that was tracked in 2005.

Water sources – Insectivorous bats, such as the Indiana bat, typically get about 20-26% of their daily water requirement by drinking water (Kurta 2004). There are approximately 5,460 miles of permanent streams and rivers on MTNF, as well as about 3000 constructed ponds, waterholes and lakes and dozens of natural ponds that can provide drinking water for Indiana bats. Four of the five Indiana bats caught on MTNF in 2003 and 2004 were captured in nets set up over woodland ponds or streams. (See Appendix F in the BA for photos). The two female Indiana bats and one male Indiana bats captured and radioed in May 2005 were captured at the same pond where another male and female were captured in 2004. About 92% of MTNF lands are within ¼ mile of a permanent water source (not including ponds on private lands or large lakes such as Table Rock or Wappapello).

Distance to Hibernacula – Indiana bats from a number of hibernacula in Missouri, Illinois, Arkansas, and Oklahoma could use portions of the MTNF at some point during the year. Males tend to stay closer to their hibernaculum than do most females. Across the range of Indiana bats, data pertaining to summer occurrences of Indiana bats show that males who stayed near hibernacula generally stay within 3 miles of a hibernacula in summer and up to 5 miles from the hibernacula in fall (U.S. Fish and Wildlife Service 1999, LaVal and LaVal 1980).
Indiana bats caught on MTNF during the summer of 2004 were found at further distances than these other studies. Capture locations ranged from 5.75 miles (Salem female) to 36.5 miles from

the nearest known hibernaculum (Poplar Bluff females). Males ranged from 6 to 29 miles from the nearest known hibernaculum. All of the captures were over 10 miles from Pilot Knob Mine, the largest hibernacula in Missouri. See Table 10 for distances for Indiana bats captured on the MTNF to nearest hibernacula and to Pilot Knob Mine. While these distances to nearest hibernacula and Pilot knob mine are provided, there is no information on where these bats are actually hibernating (with the exception of cave entrance captures).

There are also existing hibernacula in the neighboring states of Illinois, Arkansas and Oklahoma. Summer capture sites for Indiana bats on MTNF are over 100 miles from hibernacula in Arkansas and Oklahoma. The Magazine Mine hibernaculum in Illinois is about 60 miles from the nearest capture site on MTNF, and over 60 miles from the remaining capture sites. Some of the Indiana bats hibernating in neighboring states may use the MTNF during migration or summer.

Potential summer habitat on MTNF

Using the data from the 2004 captured, limited information from early 2005 captures, and summer habitat descriptions from other parts of Missouri and the Midwest, summer habitat can consist of a variety of landscapes and cover types (including urban and agricultural areas), and a variety of structural stages of forest cover (Menzel et al. 2001). Roost trees are commonly found

Table 10- Recent Indiana bat captures in relation to nearest hibernacula and to Pilot Knob Mine (largest hibernacula in Missouri)

Bat	Capture site	Nearest hibernacula	Distance (miles)	Distance to PKM (miles)
1 female 2004	Salem MTNF	Cave Hollow Cave	5.75	30
1 male 2004	Salem north MTNF	Cave Hollow Cave	6	30.75
1 male 2004	Salem south MTNF	Cave Hollow Cave	7.5	33
1 female 2003	Silver Mines MTNF	Pilot Knob Mine	11	11
1 male 2004	East Fredericktown MTNF	Pilot Knob Mine	29	29
2 females 2004	Poplar Bluff COE	Pilot Knob Mine	36.5	36.5
1 female (non NF)	Fredericktown Pvt	Pilot Knob Mine	17.7	17.7
2 males 2005	Knife Cave entrance	Knife Cave	0	88
2 males 2005	Cave Hollow Cave entrance	Cave Hollow Cave	0	20
1 male 2005	Salem MTNF	Cave Hollow Cave	5.8	24
2 females 2005	Salem MTNF	Cave Hollow Cave	5.8	24

in mixed hardwood and hardwood-pine upland forest, in riparian and bottomland forest, in wetlands, and pine-dominated forest, and have been documented in grazed and ungrazed pastures, a clearcut, hog lots, shelterwood harvest units, and burned areas for red-cockaded woodpeckers (Menzel et al. 2001) and in a developing subdivision (Belwood 2002). Foraging has been documented in riparian areas, woodlots, upland forests, over ponds, and at the edges of pastures, old fields, and forest/stream edges (Menzel et al. 2001).

About 5% of MTNF is in openland (pasture, old fields, glade, and warm-season grasses) and 95% is in forest cover. The current composition of MTNF is about 3% regenerating forest (0-9 years old), 18% young forest (10-49 years old), 55% mature forest (50-89 years old), and 18% old growth (>= 90 years old). Most of the Forest is composed of oak-hickory forest (66%), with a substantial portion in oak-pine (14%) and pine (9%). The remaining forest cover is cedar/cedar-hardwood (4%) and various kinds of other hardwoods (i.e. bottomland hardwoods, maple) (1.5%). MTNF lands are interspersed with other ownerships, including other agency and private lands. These ownerships are also a combination of forest of varying ages and types, and openlands.

Based on the descriptions of Indiana bat summer habitat across the species range, most of the MTNF could be considered suitable summer habitat – either for roosting or foraging or both. However, this may not be the case because Indiana bats are not likely to be equally abundant in all parts of its range because optimal or even suitable habitat conditions are not found equally across the landscape (Brack et al 2002). Not all areas on the MTNF have large suitable roost trees with high solar exposure with suitable foraging areas (more openly wooded areas). Generally regenerating forest areas would not be considered as suitable habitat areas; however, Timpone (2004) observed Indiana bats roosting in both clearcuts and basal-area-retention harvests (20-30sq.ft. BA retained) where some suitable roosts were maintained. These areas were treated only two years prior to Timpone's work. Implementation of the 1999 Programmatic Biological Opinion required the retention of suitable roost trees in regeneration harvest areas from a minimum of 15 to 25 sq. ft. BA; therefore those areas are likely still suitable for Indiana bats. It may be more plausible however, to discount those areas with high canopy closures and high stocking rates from estimates of suitable habitat, as those areas may have fewer suitable roosts and fewer foraging opportunities.

The reasons for the low capture rate across the 1.4 million acre Forest are unclear, but LaVal and LaVal (1980) suggested that one reason Indiana bats migrate to unglaciated regions (i.e., the Ozark region of the MTNF) in summer is due to competition for food from gray bats. Gray bats eat primarily insects with aquatic larval stages. In the southern part of the range, terrestrial insects are over 90% of Indiana bat diet (Brack and LaVal 1985 as cited in Murray and Kurta 2002), while in the northernmost sites in Michigan (where gray bats and eastern pipistrelles are absent), aquatic insects make up the majority of Indiana bat diet. Competition with gray bats for larger aquatic insects and with eastern pipistrelles for smaller aquatic insects may be the reason Indiana bats eat primarily terrestrial insects in the southern parts of the range. It may also explain why female Indiana bats in the large hibernating colonies migrate north for the summer (Gardner and Cook 2002, Whitaker and Brack 2002). Whether or not interspecific competition is occurring on MTNF is unknown, but gray bats are the third most captured species and eastern pipistrelles are the fourth most captured in six years of mist-net surveys on MTNF (Sybill Amelon pers. comm. 2005). Red bats are the most commonly captured species, followed by northern long-eared bats.

The range of the Indiana bat is very large, but during the summer, this tree roosting bat has been recorded most often in parts of its range that are fragmented with large, open, unforested areas and is typically not common in heavily forested regions (Brack et al. 2002). Brack et al (2002) state that "There is no evidence that the Indiana bat was ever common in the eastern United States, despite vast forests that seemingly could be used by a tree-dwelling bat and caves that could be used for hibernation. Obviously, many other factors affect distribution, abundance, and

reproductive success of the species; climate, on a larger scale, and weather, on a more local scale, are notable examples. We believe that a unique association of summer and winter temperatures, a combination that is lacking over much of the range of the Indiana bat, accounts for substantial, geographic differences in abundance of this endangered species." They also conclude "it is unlikely that the species was or will be equally abundant in all parts of its range." Whether or not these are factors operating in southern Missouri and the reasons for low summer capture rates are also unknown, but the evidence appears to be pointing in this direction.

Maternity Roost Trees - Studies done on maternity colonies have found that female Indiana bats roost primarily in relatively large, dead or near dead trees with some flaking, exfoliating bark (Kurta 2004; Miller et al 2002; Menzel et al. 2001). Although some female Indiana bats have been found roosting in living shagbark and shellbark hickory or other living trees with naturally curling bark, some researchers feel that living trees are only used if suitable dead trees are not available (Carter 2003). Most trees favored as roosts by maternity colonies are greater than 9" dbh (Kurta 2004). All maternity roost trees discovered on MTNF to date are dead trees at least 9" dbh or larger.

On MTNF, about 1 million of the 1.5 million acres (74%) are in forest cover greater or equal to 50 years old. Most of this acreage would have average tree diameters of 9" dbh or greater.

Maternity colonies typically choose roost trees that are exposed to solar radiation for a good part of the day (Menzel et al. 2001; Kurta 2004), which means that many roost trees are located at the edge of an opening or in a canopy gap. All of the maternity roost trees discovered to date on MTNF are in open canopy situations or in canopy gaps where they are exposed to the sun.

Approximately 3% of MTNF is in regenerating forest which would provide canopy gaps ranging from a few acres in size to 40 acres in size, dispersed across the Forest (see 0-9 age class Map in the BA, page 215). It is striking to note that the Salem and Potosi Ranger Districts appear to have the most of this type of habitat available. As noted above, most of the Indiana bat captures are from these Districts. Other canopy gaps of varying size exist where natural tree mortality has occurred.

Most of the documented maternity colonies are from areas in Missouri that were historically prairie (unlike MTNF) or more open forest types, and are now primarily agricultural. Rangewide, in counties that contain documented maternity colonies, 76% of the land is non-forested (Gardner and Cook 2002). Gardner et al (1991) evaluated landscape settings of Indiana bat maternity habitats and found their study area contained 65% cropland or old fields, 2% other agriculture, 33% forested, and 0.1% impounded water. From this information, it would appear that MTNF does not fit the classic description of Missouri maternity habitat, since most of MTNF is not in historically prairie landscapes, and current land cover is about 95% forested. Wayne County, Missouri, in which a maternity colony was discovered on MTNF in 2004, is composed of about 80% forest cover, 16% row crops or grassland, 0.4% bottomland forest, and 3% water or wetland (MORAP 2005). Iron County, in which a maternity colony was discovered on MTNF in 2005, is composed of 85% forest cover, 15% row crops or grassland and less than 1% of water and urban area. The Cave Hollow Cave Area of Influence is 91% forest cover, 8% row crop or grassland, and 1% water. Both the Wayne County and Iron County maternity colonies are located in significantly more forested landscapes than the classic maternity colonies of northern Missouri, Illinois and Iowa prairie landscapes. There are also some recently

documented maternity colonies from more forested regions in the southern Appalachian Mountains of North Carolina and Tennessee. So, while the MTNF does not appear to fit the majority of the summer maternity habitat descriptions in the literature, it is obvious that maternity colonies do exist in these densely forested regions and most likely in areas that have more open forest types.

Male Roost Trees - Menzel et al. (2001) state that "Roost trees occur in many habitat types with different stand structures." Male Indiana bats on MTNF have almost exclusively used dead trees as roosts, and most have been relatively large trees (>= 10" dbh). Literature from other parts of Indiana bat range indicates that males may use a variety of size trees, including relatively small ones (Kurta 2004). The location of several of the male roost trees have been in dense shortleaf pine plantations, a habitat not normally considered optimum for Indiana bats. However, although the males roosted in dead pine trees, they foraged in more open upland forest and along nearby riparian corridors. About 95% of MTNF is forested with trees in various densities and of various diameters which could provide potential roost trees for male Indiana bats.

Foraging Habitat – Indiana bats forage in a variety of habitats, including upland and riparian forest with canopy closures from 30%-100%, over clearings, along the edges of cropland, wooded fencerows, and over farm ponds in pastures (LaVal et al 1977; Brack 1983; Gardner et al. 1991; Butchkoski and Hassinger 2002; Murray and Kurta 2002; Garner and Gardner 1992). Indiana bats have also been documented foraging in recent harvest units (Gardner et al. 1991). Foraging distances probably depend upon habitat quality and insect abundance, and have been documented to be from about ½ mile to about 5 miles from roosts for females and about ½ mile to about 2 miles from roosts for males.

There is speculation that the best foraging habitat is composed of a diversity of forest and non-forest types since emergence of arthropods upon which Indiana bats feed is likely asynchronous among various cover types, presumably resulting in a continuous supply of insects throughout the summer (Farmer et al. 2002). Food-producing cover types used for a habitat suitability index model for the "core" maternity range of northern Missouri, southern Iowa, Illinois, southern Michigan, Indiana, and western Ohio, include: row crops, pasture, hay field, wetlands, water, early successional habitat, upland deciduous forest, riparian/floodplain deciduous forest, and coniferous forest (Farmer et al. 2002). The best foraging area was considered to be where at least four of these types (comprising at least 10% of the area) are found within a 1.2 mile landscape (Farmer et al. 2002). Others believe perfect foraging habitat includes forested streams interspersed with grasslands, croplands, or shrublands, and that open habitats such as agricultural fields and old fields are critical maternity foraging habitat in heavily forested landscapes (Sparks et al. In Press).

Currently, MTNF is about 5% open habitats, 3% regenerating forest, about 18% pole sized forest, about 55% mature sawtimber sized forest, and about 18% sawtimber sized forest greater than 90 years old. Canopy closures are generally dense, with some areas with moderate to low canopy closure. About 90% of MTNF has forest cover with canopy closures from 30%-100%. Those areas with over 80% canopy closure may not provide ideal foraging habitat – as foraging through dense canopies would be energetically expensive. More suitable foraging habitat may be needed on the MTNF.

Summer occurrence of Indiana bats within the action area but adjacent to or near MTNF

Occurrences adjacent to or near MTNF can give us valuable information about potential habitat use on MTNF.

Contractors for Fort Leonard Wood (FLW) captured one adult non-reproductive male Indiana bat on MTNF lands and none on FLW lands during surveys from 1998-2002. There is only one report of a reproductively active female on FLW (early 1990's), despite several years of summer surveys to comply with their biological opinions. The accuracy of the identification of this capture has been questioned (Lynn Robbins, Missouri State University, personal communication 2005).

Contractors for the Corps at Lake Wappapello in southeast Missouri captured 2 lactating female Indiana bats and 2 Indiana bats not sexed or aged during the summer of 2002 within the St. Francois watershed. In this same location, 1 adult male was captured in mid-August 2003. An additional 2 lactating females were captured at a separate location in July 2003. It was these two females that were tracked to a roost on the Poplar Bluff Ranger District.

On August 2, 2004, Mark Yates captured an adult non-reproductive female Indiana bat near Farmington, Missouri also in the St. Francois watershed. The bat was captured on private land, about 5.5 miles from National Forest land. The net was set up over a stream and the surrounding habitat was hayfields mixed with bottomland, swampy forest with abundant snags.

An Indiana bat maternity colony is located in Ste. Genevieve County on the Mississippi River. This colony is located about 24 miles from the nearest National Forest System land on the Fredericktown Unit. This colony was discovered through survey and radio-tracking by contractor WDH Ecological Services in March – October 2001. Female Indiana bats were captured and radio-tracked to several roost trees. At least one of these roost trees was across the Mississippi River in Illinois. One roost was in a power pole on private property. The main roosting area was located on an island in the Mississippi River. This colony was estimated to contain about 230 Indiana bats. It is not clear where these bats spend the winter, or in which direction they migrate to their hibernacula. The colony is about 40 miles east of Pilot Knob Mine, the largest hibernacula in Missouri, and about 80 miles from the Magazine Mine hibernacula in southern Illinois. Male Indiana bats were also captured in this area and radio-tracked to 3 roosts in dead silver maple trees.

It is now evident that Indiana bats use the Ozarks, especially in the St. Francois and Meramac watersheds, Mississippi River area, and the areas around known hibernacula.

Existing Migrating habitat on MTNF (Spring & Fall)

Migrating corridors or patterns for Indiana bat are essentially unknown, as is Indiana bat habitat use or behavior during migration (Menzel et al.2001). There are some data from banding records showing migrating paths to and from specific caves, but there is no clear overall picture of where and when Indiana bats migrate. The only two information sources regarding migration in Missouri show movement between hibernacula, north from Ozark hibernacula to summering areas in northern Missouri and southern Iowa (Myers 1964; LaVal and LaVal 1980), and from maternity colonies in Illinois to hibernacula in Missouri (Gardner and Cook 2002). Recent

radio-tracking efforts in New York and Pennsylvania documented an Indiana bat traveling 60 miles in one night and 35 miles another night (Sybill Amelon, pers. comm. 4/26/05). The furthest known migration is 330 miles from a hibernaculum in Kentucky to a maternity area in Michigan (Kurta and Murray 2002).

Since the Ozarks contains all of Missouri's major hibernacula, and most documented maternity sites are in areas north and east of the Ozarks, the Forest Service assumes that migrating Indiana bats must be using some Forest habitat during migration. However, it is not clear if habitat needs during migration are the same as in summer maternity or male sites, or are different.

The extent of existing migrating habitat on the MTNF is not known, but we assume that any part of MTNF could be potential migrating habitat, and that Indiana bats may roost in dead trees or living trees with flaking bark during the day, and forage in riparian and/or upland forests during the night.

More information is needed about migrating paths, habitat use during migration, and timing of migration.

Existing Swarming habitat on MTNF (Fall)

Fall harp trapping at both White's Creek and Cave Hollow Caves resulted in the capture of one and three Indiana bats respectively. Harp trapping has not been conducted in the fall at Davis #2 or Knife Caves. We do not know if any of the four hibernacula on MTNF serve as swarming sites, or if the bats using these caves swarm and mate in a different location before moving to MTNF caves. Regardless, the bats which use MTNF caves for hibernation most likely use some area around the entrance of the caves for foraging and roosting in the days leading up to hibernation.

The best scientific information available indicates that during fall swarming, the size of area used is probably correlated with the size of the colony using the cave. At Fort Leonard Wood, Missouri, Indiana bats' mean home range was about 1650-2450 acres and the farthest distance traveled from the cave was about 3.3 miles (Romme 2002). In Kentucky, Indiana bats foraged in uplands in the fall (Kiser and Elliott 1996).

All four MTNF hibernacula are surrounded by primarily forested cover in various stages of succession. White's Creek Cave is within the 16,500 acre Irish Wilderness and adjacent to the 44 mile Eleven Point National Scenic River, which is primarily mature forest and where management activities are strictly limited (U.S. Forest Service 2005). The population using this cave is about one quarter to one half that of two of the other hibernacula that are located in managed forest.

MTNF Compliance with the Indiana Bat Recovery Plan

The MTNF has implemented actions identified in the Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service 1983). The MTNF has cooperated with the Service and MDC to erect gates at two of the known hibernacula and have erected warning signs at these hibernacula. Hibernating populations are also monitored on a regular basis on the MTNF. The implementation of the 1999 Programmatic Biological Opinion for the MTNF also led to the retention of suitable roost

trees across the Forest and reduced impacts to known population from forest management activities.

As a result of the discovery of a maternity colonies on MTNF, the MTNF is cooperating with the Forest Service's North Central Research Station (NCRS) to study habitat use of these colonies starting in the summer of 2005 (***5.1 Summer Habitat Requirements***). In addition, MTNF is cooperating with NCRS, MDC, and the Service to determine effects of forest management activities on forest bats, and Indiana bat in particular (U.S. Forest Service 2005b).

EFFECTS OF THE ACTION

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 actions that implement the Forest Plan will affect the listed species.

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 2005 Forest Plan Goals and Objectives

The goals of the 2005 Forest Plan are: 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, open woodlands, closed woodlands, and upland forest in MP 1.1 and 1.2 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. Maintaining Ozark fens and glades will provide natural openings that Indiana bats may or may not use for foraging, depending on the size of the opening.

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, multi-flora rose, and other non-native species simplify ecological systems, potentially reducing plant hosts for terrestrial insects eaten by Indiana bats. Goal 1.2 and Objective 1.2a of the 2005 Forest Plan call for 2000 acres of control of existing noxious or non-native invasive species. If implemented in areas where Indiana bats may use, the habitat availability may increase or quality of existing habitat will be improved.

Goal 1.3 and Objective 1.3 a, b, c, and d outline the protection and conservation of soils, watersheds, and water quality. Indiana bats need drinking water that is not degraded (LaVal and LaVal 1980, Krusac and Mighton 2002). The MTNF goals to maintain or improve water quality through the implementation of standard and guidelines for RMZ's, WPZ's, and other best management practices to prevent or reduce soil erosion will likely benefit Indiana bats by providing clean water for drinking and healthy aquatic systems that produce aquatic prey items.

Goal 1.4 of the 2005 Forest Plan is to provide wildlife and aquatic habitat for native plant and animal species across the MTNF and to support recovery of listed species, among other goals (see description of the proposed action above and in the 2005 Forest Plan). Suitable wildlife trees (i.e., snags, den trees) will be maintained for wildlife across the forest. Improving open woodland habitat on as least 500 acres to provide habitat for other declining open woodland species (objective 1.4a) will likely provide suitable roosting and foraging habitat for the Indiana bat. Objective 1.4c is to maintain forest or woodland cover over 85% or greater of MTNF acres to provide habitat for worm eating warblers. Maintaining forest or woodland cover across the majority of the MTNF ensures that roosting and foraging opportunities will continue to exist across the MTNF through the life of this Forest Plan.

Goal 2 and its subset of goals and objectives, implemented especially in MP 2.1, 6.1, 6.2, 6.3, 7.1, and 8.1, are all geared towards providing multiple uses across the Forest. All of these actions provide for the maintenance or creation of a diversity of habitats (the above goals and objectives also apply to these MP's) that may become or will remain suitable for roosting or foraging Indiana bats. Suitable roosts must be maintained in all harvests on the forest including regeneration harvests (i.e., clearcuts, shelterwood, salvage, etc). There are several standards and guidelines proposed that will reduce or eliminate effects to hibernating and swarming or staging Indiana bats.) See the standards and guidelines proposed below.

Management Prescription 5.1 provides for the administration of the seven designated Wilderness areas on the MTNF. Vegetation management (including prescribed burning) activities generally do not occur in wilderness areas. These areas may or may not provide suitable habitat for Indiana bats. As noted above, one Indiana bat hibernaculum on the MTNF is located in the Irish Wilderness. The area around this hibernaculum is primarily mature forest. Much of the area is too densely stocked to be considered high quality habitat for Indiana bat roosting or particularly foraging (Jody Eberly, MTNF, personal communication 2005).

The overall goals and objectives of the 2005 Forest Plan for the MTNF are consistent with the habitat needs of the Indiana bat. Suitable foraging and roosting opportunities will be maintained across the MTNF with the implementation of this plan.

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

Direct effects to the Indiana bat could occur with the implementation of the 2005 Forest Plan. The removal of occupied roost trees and prescribed fires during the period of time when Indiana bats are not hibernating may directly affect Indiana bats on the MTNF. Occupied roost trees could be removed during regeneration harvests, commercial thinning, salvage/sanitation harvests, other thinning treatments, road construction or maintenance, skid trails, fire line construction and from fire itself. In implementing the 2005 Forest Plan, approximately 10,000

acres per year would be selectively harvested and 11,250 acres per year would be harvested with regeneration techniques. Pre-commercial thinning and release and non-commercial thinning would be implemented on an estimated 4,000 acres per year and 840 acres per year respectively. Approximately 65 percent of these management activities would occur during the Indiana bats active period. Approximately 67,000 acres per year would be prescribed burned during the dormant season (while most Indiana bats are hibernating). Approximately 6700 acres per year could be prescribed burned during the growing season (May through September). Note: Most of the prescribed burning acres will be on the same acres as other vegetation management activities, so totaling the acreages may be "double counting" the actual impact. In all site specific projects proposed under the 2005 Forest Plan, suitable habitat will be maintained in all ecologically appropriate areas (e.g., most glades, pastures, and other open areas are not generally suitable habitat for Indiana bats).

There are four known hibernacula on the MTNF and 18 other hibernacula within five miles of the MTNF. Effects to hibernating, swarming, and staging Indiana bats would generally occur from activities occurring within five miles of a hibernaculum (Rommé et al. 2005). Any of the above activities could be done within the five mile areas around these hibernacula, however, they would be modified by the following proposed standards and guidelines: (Note: Our analysis of the effects of implementing each standard or guideline is in italics.)

<u>Winter and fall swarming habitat (caves and abandoned mines)</u>

- All structures placed at cave entrances must permit bats to pass with minimal danger and must not alter airflow into or out of the cave, regardless if federally listed bats currently occupy the cave.
  This measure will ensure that any future cave gate will be bat friendly (danger from entering or exiting the cave will be minimal and the gate will not change inside climate of the cave). Gating caves that are occupied by bats, including the Indiana bat, discourages or eliminates human disturbance during hibernation.

- Maintain and replace as needed, existing gates at occupied Indiana or gray bat caves.
  Maintaining the existing gates at White's Creek Cave and Cave Hollow Cave will continue to discourage and eliminate human disturbance of these Indiana bat hibernacula. Maintenance of gates constructed in the future will have the same beneficial effect.

- Periodically assess all occupied Indiana and gray bat caves to determine needs for physical protection of the cave entrance.
  This measure allows for management flexibility as new caves are found and as the physical entrances change over time due to natural environmental changes.

- Periodically monitor all cave gates and protective structures to detect trespass, vandalism, or other situations which render those structures ineffective.
  Both Cave Hollow Cave and White's Creek Cave have had minor vandalism occasionally occur. Assessing the cave gates at these hibernacula periodically will help ensure that Indiana bats are afforded protection from human disturbance during hibernation.

- Evaluate abandoned mines for use by bats prior to permanent closure.
  Indiana bats use mines for hibernation. Implementing this measure will ensure that undiscovered Indiana bat hibernacula are not destroyed.

- Except for regularly scheduled population monitoring, or other legitimate scientific purposes, do not allow human entrance to Indiana bat hibernacula during the fall swarming, hibernation, and spring emergence period.
  The MTNF works with the Cave Research Foundation to map caves on the Forest. The MDC and MTNF conduct population censuses at known hibernacula. Implementing this measure will prohibit the issuing of Special Use Permits or other authorizations for entrance into Indiana bat hibernacula during critical life history stages.

- Designate an area of at least 20 acres completely surrounding an Indiana or gray bat cave entrance(s)—including the area above known or suspected cave or mine passages, foraging corridor(s), ridge tops, and side slopes around the cave for permanent old growth management. Within this area, only vegetation management activities needed to reach the desired condition are allowed.
  The desired condition for this 20 acre area is old growth. Maintaining this area in old growth conditions ensures a continual supply of roost trees near the cave entrances. It also ensures that the microclimates at the cave entrance do not change, thereby also ensuring maintenance of the interior cave climate and no change to hibernating conditions for the bats. Vegetation management (likely thinning or timber stand improvement (TSI)) within this area would not occur during critical fat building stages (swarming and staging – see measures below). Some male and non-reproductively active females have been known to stay close to their hibernaculum during the summer. Thinning smaller <u>unsuitable</u> roost trees throughout the rest of the year is not likely to adversely affect Indiana bats. If suitable roost trees were cut in this area, it would likely be because it was a human safety hazard. Most hazard trees will be cut during the hibernation season (see measure below), but some may need to be cut during the summer roosting season. The most likely hazard tree removal would be along the road near Cave Hollow Cave or on the trail near White's Creek Cave, and it is not expected that this would happen often. If a suitable hazard tree was cut during the active period, the individual(s) using the tree may be injured or killed as the tree was felled or it would flush from the tree.

- Maintain an additional 130 acres of mature forest or mature woodland around each occupied Indiana or gray bat cave.
  This measure also ensures a continual supply of roost trees around each known hibernaculum, therefore benefiting roosting Indiana bats. Vegetation management (likely thinning or TSI) within this area would not occur during critical fat building stages (swarming and staging – see measures below). Some male and non-reproductively active females have been known to stay close to their hibernaculum during the summer. Thinning smaller <u>unsuitable</u> roost trees throughout the rest of the year is not likely to adversely affect Indiana bats. If suitable roost trees were cut in this area, it would likely be because it was a human safety hazard. If a suitable hazard tree was cut during the active period, the individual(s) using the tree may be injured or killed as the tree was felled or it would flush from the tree.

- The area around occupied Indiana or gray bat caves is a smoke-sensitive area. Develop prescribed burn plans to avoid or minimize smoke influences at or near these caves. Give the U.S. Fish and Wildlife Service an opportunity to review and comment on prescribed burn plans within these areas.
  The MTNF has considered the area around Indiana bat caves as a "smoke-sensitive area" since the issuance of the 1999 Programmatic Biological Opinion (U.S.F.W.S. 1999). Prescribed burns have been planned to avoid or minimize smoke at or near the caves by incorporating specific wind speed and direction, mixing height, and other parameters into their site-specific burn plans. Casual monitoring of smoke in or near caves on the MTNF and the Ozark National Forest during prescribed burns has not shown any detectable effect to hibernating bats (U.S. Forest Service 2005a). There are no documented cases of hibernating Indiana bats being harmed from smoke from prescribed burning outside of the cave. Elder and Gunier (1981) did however, note mortality of hibernating gray bats from smoke from a fire set <u>inside</u> a cave. The implementation of this measure will avoid or minimize effects of smoke on hibernating Indiana bats.

- Minimize the impact of smoke for each prescribed fire by identifying smoke-sensitive areas, using best available control measures, monitoring smoke impacts, and following applicable guidance.
  The effects of this measure are noted above.

- Within the 20 acres of old growth and 130 acres of forest or mature woodland surrounding an Indiana bat hibernacula, avoid prescribed burning and removal of suitable roost trees in the swarming and staging periods – dates to be determined individually for each cave (normally between September 1 and November 1 and between March 15 and April 31 respectively).
  The swarming and staging periods are critical periods for Indiana bats. Indiana bats mate and build up fat for hibernation during swarming season. This is also the period when Indiana bats are most likely to be roosting near the cave entrances. The hibernating populations in caves on the MTNF are small. The 150-acre area around a cave entrance may or may not be the entire roosting and foraging range of Indiana bats during this period. Avoiding prescribed burning and the removal of suitable roost trees during this time period, eliminates adverse effects to swarming and staging Indiana bats within this 150 acre area. Indiana bats that swarm or stage outside this 150 acre area have the potential to be affected.

- Prohibit timber harvest activities within 100 feet of the edge of a sinkhole, cave entrance, or within the buffer zone for wetland features.
  The implementation of this measure will protect known hibernacula, as well as undiscovered hibernacula. The buffer zone may also contain suitable roost trees that would not be removed with the implementation of this measure.

- Prohibit skid trails within 100 feet of the edge of a sinkhole, cave entrance, or other karst feature, or within the buffer zone for wetland features.

The implementation of this measure will protect known hibernacula, as well as undiscovered hibernacula. The buffer zone may also contain suitable roost trees that would not be removed with the implementation of this measure.

- Prohibit surface-disturbing mineral activities within 100 feet of the edge of a cave entrance, spring, seep, fen, sinkhole, or shrub swamp.
  Surface-disturbing mineral activities, such as drilling, near a cave would alter the cave's microclimate, possibly negatively affecting hibernating bats (by raising or lowering the temperature outside of the preferred range or by physically altering the cave site itself). The noise disturbance produced by this type of activity this close to the cave entrance may arouse hibernating bats. Prohibiting such activities in these sensitive areas eliminates these effects.

- Prohibit core drilling or other surface disturbing mineral operations over known caves and in the 20 acres designated around Indiana bat or gray bat caves and the additional 130 acres designated around Indiana bat caves.
  The effects of this measure are the same as above.

- Do not use caves, sinkholes, and other karst features when locating new common variety disposal locations or pits.
  Locating pits or other disposal locations in these areas could negatively affect water quality and could alter cave microclimate. The implementation of this measure avoids those effects.

- Do not allow camping within caves and 100 feet of a cave entrance.
  Recreational use of caves can disturb (arouse) hibernating bats. Not allowing camping within caves or within 100 feet of cave entrances can reduce recreational use of these caves.

- Locate new trails at least 100 feet from a cave entrance or wetland, unless the trail leads to an overlook or other interpretive opportunity regarding the natural feature. When reconstructing or maintaining existing trails near karst or wetland features, consider relocating the trail away from the feature.
  The effects of this measure are the same as above.

- Whenever possible, avoid road construction:
  - Above known cave passages;
  - Within 100 feet of known cave and abandoned mine entrances;

  Constructing roads (especially permanent roads) over known cave passages can destroy cave features if the use of the roads is heavy. Routing roads away from known cave passages and away from entrances will avoid adverse effects.

- Where feasible, relocate roads away from known cave entrances during road reconstruction or maintenance activities.
  Routing roads away from known cave passages and away from entrances will avoid adverse effects.

- Whenever possible, avoid temporary road construction:
  - » Above known cave passages;
  - » Within 100 feet of known cave and abandoned mine entrances;

  Constructing roads over known cave passages can destroy cave features. Routing roads away from known cave passages and away from entrances will avoid adverse effects.

The proposed standards and guidelines that must be followed during site specific project planning and implementation greatly reduce the possibility for incidental take to occur to hibernating, swarming or staging Indiana bats. The 150 acre area that will be protected and conserved around each known hibernaculum may not be the entire area used by swarming or staging bats. However, given the small hibernating populations of these caves, this area may encompass the majority of the use for these populations. At a minimum, it will serve as refugia for bats while activities such as prescribed burning are occurring nearby during the swarming or staging periods. Any Indiana bats using the rest of the five mile area around known hibernacula could potentially occupy a tree that was considered a safety hazard or could possibly be in a salvage harvest area, where suitable roost trees might be removed. If a suitable hazard tree was cut during the active period, the individual(s) using the tree may be injured or killed as the tree was felled or it would flush from the tree. Prescribed burning may occur in the area around known hibernacula. Prescribed burning would only be implemented in a manner that minimizes or eliminates the potential for smoke to enter known hibernacula, therefore not adversely affecting hibernating populations.

The 2005 Forest Plan also has standards and guidelines that minimize the environmental impacts from fireline construction. For example, firelines would be located in areas that minimize the need to remove standing dead trees before, during, and after prescribed burn operations – thereby retaining potentially suitable roost trees. Hand constructed fireline [versus bull dozer lines] is also encouraged where feasible and practical. We conclude that with the implementation of these and other standards and guidelines regarding fireline construction and given the small hibernating populations in these areas, that the potential to remove an occupied roost tree is low.

Another aspect of prescribed burning that must be considered is the method of ignition. The MTNF uses aerial and on the ground ignition methods. The majority of the fires ignited by the MTNF will be ignited using on the ground methods, by drip torch or to a much lesser extent, with the use of a terra-torch. The use of terra-torches, which "throw" fire at specific areas or trees, could cause a suitable roost or even an unknown occupied roost tree to be consumed by fire rather quickly. Any roosting bats would likely be killed. However, this method is more commonly used to burn open areas on the MTNF and is not recommended for use during the active season for Indiana bats (Jody Eberly, MTNF, personal communication 2005). Aerial ignitions are accomplished through the release of a poly (plastic) material ping pong balls that normally are completely consumed by the chemical reaction that causes ignition. These balls are filled with potassium permanganate, which completely combusts during the chemical reaction. Regular antifreeze is injected into the balls to begin the reaction. It is also consumed during the reaction (Jody Eberly, MTNF, personal communication 2005). The Service has the opportunity to review all site specific burn plans prior to their implementation if listed species are present in the project area, further ensuring that proper considerations are made to protect known occurrences.

Mop up of prescribed fires also occurs. Any snags which have been ignited are watered down. Usually with just plain water, but sometimes with a foamy substance similar to dish soap (Jody Eberly, MTNF, personal communication 2005). If the snag has too much fire in it to control while standing, it may be felled, then controlled. By this time it is likely that any Indiana bats using the tree would have flushed from the tree, but if the snag was rapidly consumed, any bats roosting in the tree could be wounded or killed.

The MTNF must also respond to wildland fires using various suppression techniques. The Forest Plan contains several standards and guidelines directing suppression techniques. One standard is to "use existing natural or manmade barriers- such as drainages, cliffs, streams, roads, and trails- instead of constructed firelines for suppression activities when the value-at risk is low and where practical and safe for firefighters and the public." This minimizes the number of potentially suitable roost trees that may be removed for suppression efforts; however, standing dead trees that constitute a safety hazard for the public or for safe fire suppression operations may be cut or removed as necessary. There is no way to know when and where wildland fires will occur and what their severity will be, therefore effects are unquantifiable. There are many standards and guidelines that direct rehabilitation of firelines for wildland fires (see Chapter 2 of the 2005 Forest Plan). These measures all reduce soil erosion, which benefits Indiana bats by maintaining good quality drinking water.

Twenty-nine Indiana bats have been captured on or adjacent to the MTNF since 2000. The majority of these captures have been males (18), nine captures were females, and sex information for two bats captured was not identified. It is more likely that a roost occupied by an individual male would be removed as a hazard tree or during salvage harvests, because much of the MTNF is in a condition that may not be suitable for Indiana bat maternity colony areas (i.e., high canopy closure, densely stocked) and the majority of female Indiana bats appear to migrate northward to maternity areas in northern Missouri and Iowa (LaVal and LaVal 1980, Gardner and Cook 2002). The individual males could be killed or injured during tree felling or more likely, the bat may arouse and fly away from that roost. Since Indiana bats use dead trees as roosts, and all dead trees eventually fall (often suddenly and without warning), Indiana bats must be aware of suitable replacements in case of emergency (Kurta et al. 1996, 2002), and thus must have some coping mechanism for this eventuality.

Prescribed burning during the non-hibernation period may also lead to the burning of an occupied roost tree which may or may not kill or injure roosting Indiana bats, particularly non-volant juveniles. The smoke from prescribed fire during the summer may or may not cause Indiana bats to flush from the roost, depending on the location on the tree where the 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 (U.S. Forest Service 2005a)), 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. The above discussion of fireline construction, ignition methods and mop up also apply here.

The following standards and guidelines direct site specific management to maintain suitable "summer" habitat or to avoid or minimize direct and indirect effects to "summering" Indiana bats. Our analysis of the effects of implementing each standard or guideline is in italics.

Summer roosting habitat

- Maintain trees with characteristics of suitable roosts (i.e., dead or dying with exfoliating bark or large living trees with flaking bark) wherever possible with regard for public safety and accomplishment of overall resource goals and objectives.
  The implementation of this measure means that in most vegetation management activities, most large living trees with exfoliating bark and large snags (dead or dying trees) will be retained where they occur on the landscape. Some potentially suitable roost trees may be removed if they are hazard trees (along roads, trails or within harvest units) or in salvage harvests where several potentially suitable snags exist and some may need to be removed. Maintaining suitable roost trees throughout the Mark Twain National Forest will benefit any Indiana bats that may occur on the Forest. This measure substantially reduces the risk of directly killing or injuring Indiana bats while they are roosting in trees.

- If occupied Indiana bat maternity roost trees are discovered, protect them from physical disturbance until they naturally fall to the ground. Designate an area of use based on site conditions, radio-tracking or other survey information, and best available information regarding maternity habitat needs. Minimize human disturbance in the foraging and roosting areas of the maternity colony until the colony has left the maternity area for hibernation. The character of the site should be maintained or enhanced year-round by (1) maintaining an adequate number of snags, including known roost trees; (2) maintaining large live trees to provide future roosting opportunities; and (3) maintaining small canopy gaps (and/or opening the mid-story) to provide a continual source of foraging habitat.
  Indiana bats are loyal to their roosting sites. Protecting the known roosts, maintaining additional suitable roosts in perpetuity, and maintaining small canopy gaps and/or opening the mid-story will benefit summering Indiana bats on the MTNF. These benefits can include more foraging opportunities and greater solar exposure for primary or alternate maternity roosts. Minimizing human activities in known maternity areas during the maternity season will reduce or eliminate the possibility of injuring, killing, harming or harassing known Indiana bat maternity colonies.

- Within the area of use (foraging and roosting) determined for each maternity colony, conduct prescribed burning only during the hibernation season.
  Conducting prescribed burning only during the hibernation season in known maternity colony eliminates the possibility of take (injury, death, harm or harassing) in these areas. Prescribed burning can create or maintain more open under- or mid-stories, possibly improving suitability for foraging.

- Using the current, accepted technology, determine the location of summer roost trees and foraging areas for female Indiana bats.
  Conducting surveys using the most current, accepted technology (e.g.; mist netting, acoustic monitoring, emergence counts, and/or radio telemetry), to determine the

location of summer roost trees and foraging areas, will help the MTNF avoid directly or indirectly affecting Indiana bats. Surveys are not always necessary in all project areas, as not all areas have suitable habitat for Indiana bats. The Service does not expect the MTNF to survey every project. The MTNF will conduct these surveys in areas with optimal habitat (high density of suitable roost trees, proximity to permanent water, suitable foraging areas) as recommended by the Service and MDC (see BA Appendix E). On the MTNF, based on surveys over the last decade, the Districts most likely to have maternity colonies of Indiana bats are the Cedar Creek Unit, Poplar Bluff Ranger District, Salem Ranger District, and the Potosi/Fredericktown Ranger District.

- If occupied Indiana bat male roost trees are discovered during the summer season (not migration), protect them from physical disturbance by designating a 75-foot radius buffer zone around the tree(s). Within the buffer zone, no ground-disturbing activity or timber harvest shall occur. Prescribed burning may be done within the buffer zone if a fireline is manually constructed no less than 25 feet from, and completely around, the tree to prevent it from catching fire. The buffer zone shall remain in place until hibernation season begins (around November 1.)
  The Houston/Rolla/Cedar Creek Ranger District, Poplar Bluff Ranger District, Salem Ranger District, and the Potosi/Fredericktown Ranger District are most likely to have summering males due to their proximity to hibernacula or maternity areas. Protecting the known roost trees while activities occur in the stand(s) surrounding the tree will avoid directly taking (i.e., injuring, killing, harming or harassing) male Indiana bats from those trees.

- Protect known male roost trees from physical disturbance until they naturally fall to the ground.
  Male Indiana bats on the MTNF have used more than one roost tree. Protecting known roost trees and other suitable roost trees across the landscape will maintain roosting habitat for male Indiana bats and ensure that if they return to the same area, suitable roost trees will be available.

- Remove hazard trees between November 1 and April 1 whenever possible.
  "Hazard trees" are in many cases suitable for an Indiana bat to roost in. Removing these individual trees during the hibernation season avoids directly taking (i.e., killing or injuring) Indiana bats. Suitable roosts will still be available in most areas where hazard trees are removed (reducing the possibility of harm through habitat loss).

- Whenever vegetation management is undertaken, leave standing dead trees, cavity or den trees, and downed woody material whenever possible, while providing for public safety and the achievement of resource management goals and objectives.
  This measure is in addition to the measures above calling for retention of suitable Indiana bat roosts. It provides additional guidance for the retention of a diversity of wildlife habitats. Indiana bats have been documented using tree cavities but have never been documented using down woody material.

- All even-aged regeneration harvests shall retain at least 7%-10% of the harvest unit in reserve trees and/or reserve tree groups.

Retaining 7-10 percent of a regeneration harvest would include live potential (future) roost trees as well as dead or dying currently suitable roost trees (see next measure). Over the next 10 years the MTNF anticipates using regeneration harvest methods (including salvage/sanitation harvest) on approximately 112,700 acres (7 percent of the MTNF acreage) across the Forest (1,495,747 acres in 29 counties). Regeneration harvests occur in areas from several to 40 acres in size, with the average stand size on the MTNF being about 15 acres (U.S. Forest Service 2005a). The retention of trees, some currently suitable and some potentially suitable in the future, in these areas provides roosting and foraging opportunities to Indiana bats (Menzel et al. 2001).

- Reserve trees and reserve tree groups should include a combination of the following:
  - The largest, long-lived species occurring on the site (pine, white oak, post oak, hickory, black gum);
  - Standing dead trees; and
  - Cavity or den trees.

  See above analysis for the retention of reserve trees. These types of trees have been found to be used by Indiana bats for roosting.

- Space reserve trees and reserve tree groups to mimic natural community structure and composition.
  See above analysis for the retention of reserve trees.

- Include a combination of at least five trees in reserve tree groups. Where opportunities permit, locate some reserve tree groups within drainages.
  See above analysis for the retention of reserve trees.

- Plan salvage activities to leave at least 10%-15% of the affected area, unless the area presents an unacceptable risk to public health or safety, or threatens forest health. These areas should be in a variety of patch sizes and distributions on the landscape.
  Salvage activities have the greatest potential to affect Indiana bats, since the majority of salvage harvest areas have many suitable roost trees. It is understood that even with the standard to retain suitable roost above, in salvage areas, it may not be possible to retain all suitable roost trees. The acreage of salvage activities is included in the regeneration harvest estimation. The retention of trees, some currently suitable and some unsuitable, in these areas provides roosting and foraging opportunities to Indiana bats (Menzel et al. 2001).

- Conduct an evaluation for the presence of Indiana bats prior to any decision to remove a building or bridge.
  Indiana bats have been documented using bridges (Kiser et al. 2002) and buildings (Butchkoski and Hassinger 2002) for day and/or night roosting. Conducting this type of survey will ensure that day and/or night roost sites are protected.

- Bridges proposed for construction or reconstruction across streams that are 40 or more feet wide should be designed of concrete with girders or chambers to provide suitable bat roosting space underneath whenever possible.

Providing artificial roost sites may benefit Indiana bats.

Summer foraging habitat

- Mimic ecosystem dynamics, patterns, and disturbance processes to achieve desired conditions except where ecological recovery is unlikely or unfeasible.
  With the implementation of the 2005 Forest Plan, habitat conditions should more closely match what they were in pre-settlement times, when the numbers and distribution of Indiana bats was likely much greater than it currently is.

- Distribute activities across the landscape to emulate the historical vegetation patterns and quantities of natural communities based on available information. (1.1, 1.2, 2.1)
  The historical vegetation of Missouri's Ozarks has changed throughout the last century due to man's influence (U.S. Forest Service 2005c). Ecosystem restoration work as proposed by the MTNF will likely improve roosting and/or foraging opportunities for Indiana bats on the Forest.

- Construct waterholes only where natural or man-made water sources are limited or lacking.
  A lack of suitable drinking water may render an area unsuitable for roosting or foraging Indiana bats. The construction of waterholes in these areas may benefit Indiana bats (Krusac and Mighton 2002).

- **For the 1.1 and 1.2 Management Prescriptions only**: New wildlife waterholes shall only be constructed if site-specific analysis demonstrates a long-term, landscape-level viability concern for TES, RFSS, species groups (such as herptofauna), and such concerns cannot be addressed through waterhole construction in other areas of the Forest (i.e. 2.1 Management Prescription).
  See above.

- Manage and rehabilitate existing waterholes as a priority over constructing new ones.
  Maintaining waterholes could benefit Indiana bats by supplying a suitable water source as well as being potential prey sources.

- Construct temporary pools at the end of outlet ditches whenever possible.
  See above

The standards and guidelines as proposed greatly minimize the chance for known occupied roost trees to be removed, therefore reducing the possibility of injuring and killing, harming or harassing Indiana bats. The MTNF will continue to survey high quality areas for Indiana bats, as outlined in the BA. All known roosts will be protected until they naturally fall, rendering them unsuitable to Indiana bats. The character of each colony's home range will not be made unsuitable and suitable roosting trees for now and the future will be maintained in the area. The MTNF generally does not mark dead/dying trees, except during salvage harvest (Jody Eberly, personal communication, 2005). Still, there is a possibility, that an unknown occupied roost tree could be removed if that tree is a human safety hazard that must be removed during the active period or possibly during salvage harvests. The standards and guidelines for implementing the

2005 Forest Plan also ensure that suitable habitat is maintained across the MTNF through the life of this project.

Overall, we believe that the potential to incidentally take Indiana bats on the MTNF is generally low. In order to quantify the risk of an unknown occupied roost tree being removed, the MTNF, asked scientists from the North Central Research Station (NCRS) to determine the statistical probability that an occupied roost tree would be removed through MTNF management activities that implement the 2005 Forest Plan.[1] Using Forest Inventory Analysis (FIA) Data, they determined that there are 25,265,376 potentially suitable roost trees on the entire MTNF. On lands not owned by the MTNF in the 29 county area, there are 90,120,283 potentially suitable roost trees available. A suitable roost tree was defined as snags and live shagbark and shellbark hickories and white oaks greater than or equal to 9 inches dbh.

To further refine the analysis, NCRS determined the number of potentially suitable roost trees in stands over 60 years old on the MTNF and other adjacent lands. Across the MTNF, there are 16,557,243 potentially suitable roost trees in stands over 60 years old. There is an additional 50,329,075 potentially suitable roost trees on other lands. The amount of solar exposure each tree receives, amount of exfoliating bark and the proximity to water or other suitable foraging areas is unknown, but stands 60 years or older will likely have some of the characteristics that make an area suitable for Indiana bats (i.e., many more larger trees exist in these stands; conversely many of the stands may be overstocked, not affording high solar exposure to some suitable roosts, nonetheless suitable habitat is generally thought to exist in older stands). Timpone (2004) however found maternity roost in recently harvested stands.

The probability of an occupied roost tree being cut on the entire MTNF is much less than that for the stands 60 years or older. The average annual number of potential roost trees (occupancy unknown) that could be removed with the implementation of the 2005 Forest Plan in these older stands is estimated to be 219,694 trees (of that approximately 11,257 are dead trees). The probability of cutting a roost tree (by definition – not occupancy) from April through September on the MTNF in stands 60 years or older is 0.013268765 or odds of about 1 in 75. The probability that any of those 16.4 million potential roost trees is occupied by the 7,987[2] Indiana bats on the MTNF at the time of removal is 0.000316133 or odds of about 1 in 3,163. The

[1] The MTNF asked scientists from NCRS (including biologists and foresters), the Missouri Department of Conservation, and the Service to review the assumptions given for the statistical analysis in a meeting in early 2005. All those present at the 3/10/05 meeting agreed that the assumptions were reasonable and that the analysis would provide valuable information on the effects of MTNF forest management direction included in the 2005 Forest Plan. Farmer et al (2002) recommends that the density of suitable roost trees be used to assess potential habitat either on a project specific or regional basis. In their study they defined a suitable maternity roost tree as being 12" dbh or greater. Indiana bats, especially males (more males expected on MTNF than females), have been documented roosting in trees much smaller than this.

[2] It was assumed that approximately 32,000 Indiana bats could be using Missouri's Ozark forests from April through September, and proportionally allocating the bats to land ownerships, there might be 7,987 Indiana bats using the MTNF during this time period (see BA for greater explanation of this assumption and 6/30/2005 email containing the entire analysis). The validity of this assumption is unknown, but it is much greater than the estimate of numbers of Indiana bats assumed to be using the MTNF in the 1999 Programmatic Biological Opinion (500 Indiana bats – U.S.F.W.S.1999). We know of no other way to determine/estimate the number of Indiana bats that could be using the MTNF. To date a total of 29 bats have been captured on or adjacent to the MTNF. Exit counts at the known maternity colonies are under 100 bats total, and the hibernating population on the MTNF is just under 300 Indiana bats.

probability of an occupied roost tree being cut from April through September is 0.000004194697 or odds of cutting an occupied roost tree are about 1 in 238,396.

The same analysis was conducted for the probability of removing an occupied roost tree through prescribed burning from April through September. The odds of this occurring are about 1 in 2,075,584. Based on these analyses and calculations, on average approximately one occupied roost tree would be cut per year (Jody Eberly, MTNF, personal communication 2005). Although there are many assumptions associated with this analysis, we believe overall the methodology gives deference to the bat. Because of these assumptions, the validity of this type of analysis is unknown, but the results are consistent with our qualitative assessment that the actions taken on the MTNF to implement the 2005 Forest Plan has a low likelihood of incidentally taking an Indiana bat through the felling of an unknown occupied roost tree.

We conclude from our analysis of effects that the chances of an occupied roost tree being cut on the MTNF are low. Given the programmatic nature of the 2005 Forest Plan on a 1.4 million acre Forest, there is a chance that a roost tree containing roosting bats could be cut somewhere on the MTNF during the next 10 years. This is particularly the case since the MTNF has been affected with oak decline for over 20 years and has about 400,000 acres of National Forest lands susceptible to further decline. While this creates an abundant supply of suitable roost trees, it also creates a forest health and fuel problem that the MTNF must address to ensure public safety and effective, sustained use of the public's natural resources (U.S. Forest Service 2005a). The removal of dead trees through salvage harvest will occur on the MTNF during this 10 year planning period. Salvage operations, hazard tree removal during the non-hibernation season, prescribed burning during the summer, and road construction/reconstruction activities have the highest possibility for [unknown] at least one occupied roost trees to be removed per year.

With the implementation of the proposed standards and guidelines in the Forest Plan on a site specific basis; range management, red cedar reduction, old growth designations, most thinning projects, and pesticide applications are not likely to adversely affect Indiana bats. Prescribed burning conducted during the hibernation season are not likely to adversely affect Indiana bats. These areas are considered smoke sensitive areas, therefore minimizing potential adverse effects to hibernating populations. Adverse effects to Indiana bats during hibernation from human disturbance are not anticipated with the implementation of the 2005 Forest Plan because White's Creek Cave and Cave Hollow Cave are gated, and a gate is planned for Knife Cave, and Davis Cave #2 does not need a gate. All known hibernacula will be monitored during the hibernation season to detect any unauthorized entry.

Indirect effects are defined as those effects that are caused by the proposed actions and are later in time, but still reasonably certain to occur (50 CFR 402.02). The main potential indirect effects to the Indiana bat on the MTNF would be: 1) a potential reduction in the species' forage base due to loss of foraging habitat; 2) loss of the species' prey base due to the degradation of water quality of streams and rivers within riparian corridors over which the species forages that could negatively impact the emergence and abundance of insects within such corridors and 3) temporary loss of roosting habitat.

The 2005 Forest Plan eliminates the 3.5 Management Prescription (Indiana bat areas of influence) developed in response to the 1999 Programmatic Biological Opinion. The purpose of that prescription was to provide management to protect Indiana bats and their habitat in and

around hibernacula and known sites of reproductively active females. These areas would be of variable sizes and would provide a continuous supply of suitable roost trees and preferred foraging habitat for Indiana bats. The type of management proposed in the 2005 Forest Plan (ecosystem restoration and enhancement of natural communities) coupled with the standards and guidelines developed to protect and/or maintain or enhance Indiana bats and their habitat on the MTNF would provide the same or greater benefits to the species than the 3.5 management prescription (see Appendix E of this Biological Opinion for a point by point comparison of the 1999 PBO management, versus proposed management).

Forest management activities which (either temporarily or permanently reduce forest canopy closure to less than 30% (i.e., certain types of timber harvest, new road construction, and new utility corridors) could potentially reduce the availability and/or suitability of those areas as foraging or roosting habitat. However, the potential adverse impacts from indirect effects to Indiana bats are expected to be minor for the following reasons:

- The standards and guidelines outlined in the 2005 Forest Plan provide significant protection for riparian corridors (potentially suitable roosting or foraging habitat) on the National Forest. Management activities in these areas are either limited or prohibited, enabling the ecological integrity of these areas to be maintained into the foreseeable future. For example, livestock grazing and fertilizers cannot be used in RMZ's and WPZ's. Best management practices will be implemented to reduce or eliminate soil erosion also.
- Overall vegetation management on the MTNF would not reduce the suitability of known roosting and foraging areas and may create new foraging and roosting opportunities (Gardner et al. 1991b; Gumbert et al 2002; Menzel et al. 2005a; Menzel et al 2005b).
- Extensive research indicates that this species forages over a wide variety of habitats including riparian corridors, upland areas, fields, shelterwood cuts, and other disturbed areas (Timpone 2004, Gardner et al. 1991b; Gumbert et al 2002; Menzel et al. 2005a; Menzel et al 2005b), therefore the diversity of habitats created through the implementation of the 2005 Forest Plan will provide varying roosting and foraging opportunities across the MTNF.
- Ecosystem restoration projects and general forest management projects (including prescribed burning) that open the forest canopy in areas where the canopy closure is greater than 80% to more suitable levels will undoubtedly increase habitat diversity Forest-wide and therefore insect abundance (Romme' et al. 1995, Krusic and Neefus 1996; Gumbert et al 2002; Menzel et al 2005a, Schultes and Elliot 2002).
- Given the proposed standard to maintain the character of known maternity sites, we conclude that the existing home ranges of known maternity colonies will not be adversely affected and will likely be improved by management actions that occur during the non-active season.
- Given the extensive standards and guidelines to minimize soil movement, sedimentation into waterways, and to protect water quality and quantity, most projects would have little to no impact on water quality.

Species Response to the Proposed Action

The implementation of the 2005 Forest Plan affords many long term benefits to Indiana bats using the MTNF. Some projects may have short term adverse effects to Indiana bats using the MTNF.

Hibernating Populations

Populations of Indiana bats hibernating on the MTNF will be protected from human disturbance through gating and monitoring of those gates. Newly discovered hibernacula will be evaluated for their protection needs. Hibernacula are designated as smoke sensitive areas, alerting MTNF personnel of the need to plan prescribed fire in a way that minimizes or avoids smoke impacts to the cave such that any effects will be insignificant or discountable. Physical disturbance to the immediate (20 acre area of old growth) area around the cave and the greater 130 acres of mature forest or woodland will be very limited (see above). Recreational opportunities are also very limited in the immediate area around a hibernaculum. All of the known hibernacula on the MTNF are Priority 3 hibernacula. The populations of these caves in 2004-2005 range from 26 to 150 Indiana bats. The populations in these caves have fluctuated for unknown reasons since they were first surveyed. We expect that the implementation of the 2005 Forest Plan will benefit hibernating Indiana bats on the MTNF by maintaining bat friendly gates that eliminate (or discourage) unnecessary human disturbance to hibernating bats, signing occupied bat caves, by monitoring potential trespass at known hibernacula, by periodically assessing hibernacula for physical changes that may trigger new protective management actions, and by conducting surveys for Indiana bats prior to closing access to mines that may harbor hibernating Indiana bats

Swarming, Staging and Migrating Indiana Bats

Swarming and staging Indiana bats will be afforded many benefits with the implementation of the 2005 Forest Plan. Maintaining 150 acres around the hibernacula on or adjacent to the MTNF will maintain suitable roosting and foraging habitat during these critical mating and fat building life history stages. Avoiding prescribed burning and removal of suitable roost trees during the swarming and staging will also eliminate adverse affects to Indiana bats in this 150 acre area. Any Indiana bats swarming or staging outside of this 150-acre area has the potential to be adversely affected, but we expect the possibility for take to occur to be low with the implementation of the proposed standards and guidelines, because most hazard trees would be removed while bats are hibernating. If an occupied roost tree was cut during this period, it is more likely that a male would be using the tree since males use a larger area for a longer period of time than do females (Rommé et al. 2002, LaVal and LaVal 1980). Gumbert et al (2002) recommend creating a diversity of habitats near hibernacula while maintaining known roosts and maintaining a continuing supply of roosts.

The migratory patterns of Indiana bats using the MTNF are largely 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 MTNF will not change as site-specific projects are implemented. Even in regeneration harvest (generally less than 40 acres), reserve trees will be left including suitable roosts (Gumbert et al 2002). Most dead and dying trees are not marked for harvest on the MTNF, except during salvage harvest (Jody Eberly, MTNF, personal communication, 2005) and there is a standard to maintain all suitable roost trees that are not a

safety hazard (unless the management direction provides a solid reason not). Foraging opportunities will remain available at least at the edges of the regeneration harvests and most likely within the harvest unit itself. Forested corridors are abundant on the MTNF, providing typical commuting corridors. Prescribed burning and harvest could occur when Indiana bats are migrating to or from their hibernaculum. The MTNF encompasses over 1.4 million acres and there are over 65,000 Indiana bats (total Missouri population) that could potentially be migrating through almost anywhere on the Forest or in the entire 29 county area. The probability that a migrating Indiana bat would be encountered, much less taken, is very remote because there are many potential travel corridors (i.e., woods roads, county roads, trails) throughout the MTNF and because most suitable hazard trees would be removed during the period when bats are hibernating. If bats were to migrate through an area being treated by prescribed burning, they may or may not choose to stay in the area to take advantage of insects drawn to smoldering areas, or they may just choose to continue along their migratory route.

Maternity Colonies

There are three known maternity colonies on the MTNF, one on the Poplar Bluff Ranger District and possibly two colonies on the Salem Ranger District (see status of the species on the MTNF). Another capture of one pregnant Indiana bat on the Potosi/Fredericktown Ranger District did not lead to the discovery of the maternity roosts. Subsequent surveys of that area did not result in the capture of any other Indiana bats. The maternity colony this female belonged to may occur elsewhere on the Forest or roosting and foraging areas may occur on adjacent private or state land. These three Districts and the Cedar Creek Unit (given that it is north of the Missouri River, where most Missouri Indiana bat maternity colonies have been documented) have the highest probabilities for maternity colony activity. Extensive surveys (mist net and Anabat) across the Forest since 1997 during the appropriate season (May 15-August 15) have not documented maternity colonies on the Ava/Cassville/Willow Springs Ranger District, the Eleven Point Ranger District, or the Houston/Rolla/Cedar Creek Ranger Districts. Appendix F is a map of Indiana bat captures on the MTNF.

With the implementation of the 2005 Forest Plan (including surveys for Indiana bat presence in high quality habitat), known maternity colonies will be protected from direct adverse effects. 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 MTNF. These benefits can include more foraging opportunities and greater solar exposure for primary or alternate maternity roosts (Krusic and Mighton 2002; Miller et al 2002). Minimizing human activities in known maternity areas during the maternity season will reduce or eliminate the possibility of injuring, killing, harming or harassing known Indiana bat maternity colonies.

With the implementation of the 2005 Forest Plan, and as further demonstrated by the above probability analysis, and given that maternity colonies are so infrequently encountered on the MTNF, the chances of removing an unknown occupied roost through any management activity on the MTNF is likely very small. If an occupied (unknown) roost 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. Since the MTNF will not be cutting all of the suitable roost trees in any one area, it is

likely that suitable (perhaps alternate or other primary) roosts would remain available for use by that colony (Kurta et al 2002).

It is also likely that roosting and foraging opportunities for maternity colonies will increase as a result of the implementation of the 2005 Forest Plan. Management activities (including but not limited to: single tree selection, shelterwood harvests, prescribed burning) that create small canopy gaps, open up the understory (foraging through heavy forest clutter is energetically expensive), 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 (U.S. Forest Service 2005c).

"Summering" Males and Non-reproductive Females

Given the number of Indiana bat hibernacula in Missouri's Ozarks, including four known hibernacula on the MTNF, 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 25.3 million suitable roost trees on the MTNF to be actually occupied at some point by these individuals. As noted above, the majority of captures on the MTNF have been of individual males.

If an occupied roost 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 MTNF 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).

It is also likely that roosting and foraging opportunities for summering individuals will increase as a result of the implementation of the 2005 Forest Plan. Management activities (including but not limited to: single tree selection, shelterwood harvests, prescribed burning) 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; U.S. Forest Service 2005c).

Overall, we conclude that the risk of incidental take occurring through the implementation of the 2005 Forest Plan is very low. By conducting the probability analysis, including its limitations, we believe that on average one unknown occupied roost tree may be cut per year.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, 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 under section 7 of the Act.

Reasonably foreseeable actions on other ownerships are difficult to predict, since there are so many owners within the 29 county area. Other state and federal landowners or managers include

Missouri Departments of Conservation (MDC), Missouri Department of Natural Resources (MDNR), the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, National Park Service, and state and federal Highway Departments. Each of these agencies has a different purpose and objectives for management of their lands. Land management on these other agency lands can be reasonably predicted based on past practices and planning documents.

While all have differing management objectives, the state and federal land management agencies all have conducted similar management activities over the past years that are indicative of the types of reasonably foreseeable future actions that could occur. These include forest and openland management through prescribed burning, various types of timber harvest, limited herbicide use, providing recreational experiences, and for the Army Corps of Engineers, adjusting lake levels for flood control, hydropower production, and recreational use. Activities on other federal ownerships are also subject to Section 7 consultations and thus would not be included in the discussion of cumulative effects as defined by ESA.

The state and federal Highway Departments regularly conduct road and highway maintenance, as well as various road reconstruction and relocation projects across the state. Several highway projects are proposed within the 29 county area for the foreseeable future. The Missouri Department of Transportation website shows projects planned over the next decade (http://www.modot.state.mo.us/plansandprojects/construction_program/stip5year.htm). Federal Highway projects, and state projects which use federal monies would be subject to Section 7 consultations and would not be included in the discussion of cumulative effects as defined by ESA.

There are literally thousands of private landowners who own property within the 29 counties that contain National Forest lands. However, past trends on private properties within these counties are some indication of reasonably foreseeable trends for the future.

Those activities on private ownerships which may be reasonably expected to occur and which might have some impact on Indiana bats or their habitat include:

- Continued commercial use of some Indiana bat caves;
- Non-commercial, recreational use of occupied Indiana bat caves resulting in disturbance to the bats;
- Land clearing, road construction, and other uses that may result in permanent loss of forest cover and large, dead trees, and potential sedimentation of streams;
- Agricultural use of insecticides.

In addition, private landowners also conduct burns (usually small) on their land and wildfires occur on both National Forest and private ownerships within the proclamation boundary.

Any of these activities would have varying degrees of effects on Indiana bats, ranging from no effect to adverse effects. Human disturbance in hibernacula and permanent conversion of lands to unsuitable habitat (i.e., urban and residential development, road construction, permanent pasture with few or no remaining trees, etc.) would have the greatest potential impact to Indiana bats. Other activities would have the same general effects as MTNF activities would providing they are implemented with similar methods and protective measures.

We can not accurately quantify how much forest land on private lands will be converted to other habitat types, the extent of future timber harvest on private lands, nor the amount of privately owned habitat that will be developed for other purposed. As noted in the environmental baseline section, average annual removals of growing stock on private lands totaled 100.0 million cubic feet per year (Moser et al 2005) from 1989 to 1999-2003. Treiman and Piva (2005) reported that the total growing stock removed on both public and private lands was 130 million cubic feet in 2003. In 2003, Missouri's wood industry was comprised of 371 sawmills, 8 cooperage mills, 8 post mills, 4 charcoal plants, 5 handle mills, 1 veneer mill, 1 pulp mill, and 6 mills producing other products (Treiman and Piva 2005). We expect that most of these still exist, but some may have closed, given that the trend for these industries decreased from 2000 to 2003 (Treiman and Piva 2003). Treiman and Piva (2005) reported that approximately 93 percent of the roundwood processed by these mills was cut from Missouri's forest lands. Therefore we can be reasonably certain that timber, including some suitable Indiana bat habitat, will be removed on Missouri's private land and other public lands. At the same time, information indicated that there are currently sufficient suitable roost trees on private lands and this trend is expected into the future. The average annual tree mortality (i.e., "creation" of suitable roost trees) is highest on private lands in Missouri (estimated at 65.9 million cubic feet/year). The future supply of roost trees on private lands is also secure, with an average annual net in stock increase estimated at 629 million cubic feet/year. This information can not be used to determine how many of these snags actually have the characteristics suitable for roosting (i.e., sloughing bark, high solar exposure, proximity to water) but based on qualitative observations of the area, suitable habitat for roosting and foraging does exist and will likely continue to exist in many areas throughout the action area on private and public lands.

CONCLUSION

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed 2005 Forest Plan for the Mark Twain National Forest, and the cumulative effects, **it is the Service's biological opinion that the 2005 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.

This conclusion is based on the following factors:

- Hibernating Indiana bats on the MTNF are not likely to be adversely affected with the implementation of the 2005 Forest Plan;
- Approximately 300 Indiana bats hibernate in caves on the MTNF. Most of these bats can be expected to swarm, mate or stage near the four known hibernacula. The implementation of the standards and guidelines contained in the 2005 Forest Plan will greatly reduce or completely avoid (in the 150 acre area around the cave entrance) the potential for adverse effects (i.e., injury, death, habitat loss) to occur in these areas;
- There are three known maternity colonies on the MTNF (with exit counts under 100 bats total for all colonies). Direct effects to known maternity colonies will be avoided with the implementation of the 2005 Forest Plan. Indirect effects through habitat loss will also be avoided, since the standards and guidelines state that habitat in those areas must be maintained or enhanced.

- The probability of unknown occupied roost trees being removed through salvage harvest or hazard tree removal with the implementation of the 2005 Forest Plan is very small – on average, one per year (see above probability analysis). If a tree was cut that had an unknown maternity colony roosting in it, most of the bats would likely escape unharmed, including non-volant juveniles (Belwood 2002, Carter et al 2002). Some individuals may be injured or killed. Since the MTNF will not likely be cutting all of the suitable roost trees in any one area, it is likely that suitable (alternate and/or primary) roosts will remain available for that colony.
- With the implementation of the 2005 Forest Plan, it is likely that more optimal roosting and foraging conditions will be created on the MTNF.
- The majority of Indiana bat captures on or adjacent to the MTNF have been males. As noted above, the probability of cutting an occupied roost tree on the MTNF is very small. It is very unlikely that an individual bat would stay in a tree being cut down or if it did, the odds that the tree would fall exactly on the spot in the tree that the bat was roosting in are incredibly remote. Any predation risk is considered insignificant. Hence, we do not anticipate any reductions in colony fitness, but anticipate mortality or injury to male bats. The number of bats with this fate, however, is believed to be very small. Thus no appreciable reductions in reproduction, numbers, and distribution are expected within the action area.
- The range wide rate of decline for the Indiana bat has slowed. Recent counts for the first time in 60 years show an increase in the overall population, although we are unable to interpret the meaning of these increases in terms of current population trends.
- As the proposed action will not reduce the fitness of individuals occurring within the action area, the viability of the hibernating populations in which these individuals belong will not be reduced. Therefore, the proposed action is not likely to appreciably reduce the reproduction, numbers, or distribution of Indiana bats range wide.

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 attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species, to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Mark Twain National Forest so that they becoming binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption of section 7(o)(2) to apply. The Mark Twain

National Forest has a continuing duty to regulate the activities covered by this incidental take statement. If the Mark Twain National Forest (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Mark Twain 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)]

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 2005 Forest Plan for the MTNF (loss of roost trees through salvage harvest or hazard tree removal). The 2005 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 2005 Forest Plan (and all of the standards and guidelines within), we expect that some adverse effects to Indiana bats may occur. As such, *some* site-specific projects (i.e., salvage harvest, hazard tree removal for different projects) (not all), conducted under the 2005 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 2005 Forest Plan. Therefore, projects completed under the 2005 Forest Plan that comply with all of the standards and guidelines and other project commitments detailed in the BA 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, an unknown occupied roost tree could be removed, particularly during salvage harvest or hazard tree removal. We believe that no more than one such roost would be removed per year on average. The likelihood of such instances is strongly influenced by the timing and the location of the activity within the MTNF.

The results of the probability analysis presented above determined that on average one occupied roost tree per year would be cut on the MTNF during salvage harvest or hazard tree removal. The project period for the 2005 Forest Plan is ten years. Therefore, we anticipate that up to 10 occupied roost trees might be removed through salvage or hazard tree cutting 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 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 MTNF is largely unknown but is thought to be limited based on extensive survey efforts and current capture data;

5. Implemented actions will not affect all of the available habitat within a project area as a result of salvage harvest or hazard tree removal (i.e., implementation of protective standards and guidelines that the MTNF will implement on a project-specific basis will ensure that suitable habitat remains in the project areas); and

Since the number of Indiana bats that may be taken through the implementation of the 2005 Forest Plan cannot be adequately determined or 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. All known roosts on the MTNF have been dead trees (snags). The MTNF does not generally mark dead or dying trees during timber sale activities including regeneration harvest types (Jody Eberly, MTNF, personal communication 2005); however, actions that may cause the removal of potentially suitable snags include salvage sales, road construction or reconstruction, and hazard tree removal. Incidental take will be monitored using the number of acres provided in Table 11.

Table 11. Annual estimated management activities causing removal of Indiana bat habitat on the MTNF.

Activity	Measure
Salvage Sales (even-aged or uneven-aged harvest)	15,000 acres
Hazard Tree Removal*	4,400 acres and 240 miles of fireline
TOTAL	19,400 acres and 240 miles of fireline
* Hazard tree removal includes 1500 acres of recreation site maintenance per year; 2000 acres of trail maintenance per year; 100 acres of road construction/reconstruction per year; 800 acres temporary roads and skid trails per year; and 240 miles of fireline per year. **Hazard tree removals are generally individual trees being removed, not acres of forest being removed.** These numbers are inflated estimates of acres that could be affected across the MTNF throughout the 10 year project period.	

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 (approximately one occupied roost tree per year – see above) spread over 19,400 acres and 240 miles (the surrogate measure to monitor incidental take) constitutes approximately 1.3 percent of the total forested area on the MTNF being affected by activities that may cause incidental take, per year.

Across the MTNF there are over 14.7 million potentially suitable roost trees (dead/dying tree over 5" dbh) (Jody Eberly, MTNF, personal communication, 2005). Some of those potentially suitable roost trees will be removed. Therefore, *at least* 14 million potentially suitable roost trees would be available across the MTNF throughout the project period. This equates to roughly 1800 potential roost trees available per each of the 7987 Indiana bats that could be using the MTNF. If *all* of the hibernating Indiana bats in Missouri (65,104) were to use the MTNF (and we know they do not) there would still be over 200 potential roost trees available **per** bat.

Although there are many assumptions factored in this analysis, it does suggest that there will be an abundance of suitable roost trees for bats on the MTNF and that 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 impacts of incidental take of Indiana bats:

1. Decrease possible adverse impacts to Indiana bats due to the removal of suitable roost trees during salvage harvest or hazard tree removal.

2. Monitor the status of Indiana bats on lands managed by the MTNF and the levels of incidental take given.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Mark Twain 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 salvage harvest or hazard tree removal, 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 must be considered and such habitat must be maintained or enhanced in that area.

b. Inform Forest Service employees who normally remove hazard trees of the new standard that restricts hazard tree removal to the period between November 1 and April 1 whenever possible, with regard to human safety.

c. On the Salem, Potosi/Fredericktown, Houston/Rolla/Cedar Creek, and Poplar Bluff Ranger Districts, inspect (e.g., perform emergence counts) hazard trees that must be removed during the non-hibernation period for occupancy by Indiana bats within 24 hours of removal of the tree. These four Districts are most likely to be used by Indiana bats based on recent summer captures and/or high number of hibernacula.

2. To monitor the status of Indiana bats on the MTNF and to monitor anticipated levels of take, the following is necessary:

a. Continue monitoring occupied Indiana bat hibernacula on the MTNF to assess changes in population numbers, changes in microclimate, the effectiveness of protective structures currently in place, etc.
b. Continue monitoring the extent of use by Indiana bats on the MTNF. Such monitoring should include the employment of currently accepted techniques used to gather information on the Indiana bat on the MTNF. Continue to use the current survey strategy

as outlined in the BA – prioritizing the surveying of areas that have a higher probability of having Indiana bat use or more optimal habitat conditions (especially on the Salem, Potosi/Fredericktown, Poplar Bluff, and Houston/Rolla/Cedar Creek Ranger Districts).

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

d. Continue to use the computer program (known as the BE Program) or other mutually agreed upon methods developed by the MTNF 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 MTNF using Forest Inventory Assessment (FIA) data once every five years at a minimum.

f. The amount of incidental take as identified in this opinion must be monitored on an annual basis. Work with the Columbia, Missouri Ecological Services Field Office to develop a monitoring form for all Districts to use.

g. The results of all monitoring activities shall be provided to the Service's Columbia, Missouri Ecological Services Field Office and MDC, no later than December 31 of each year.

h. Provide to personnel of the Service's Columbia, Missouri Ecological Services Field Office, and to MDC, an opportunity to conduct site visits to all Districts of the MTNF, to evaluate compliance of monitoring requirements. Site visits will be scheduled by mutual consent of the Service and personnel of the MTNF.

Though highly unlikely, upon locating a dead, injured, or sick Indiana bat, initial notification must be made to the Fish and Wildlife Service Ecological Services Office at Columbia, Missouri. 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 annually no more than 1**occupied** roost trees will be incidentally taken or for monitoring practicality, no more than 19,400 acres of activities where suitable roost trees are likely to be removed or 240 miles of fireline per year. If, during the course of the action, this level of 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 MTNF implement the following conservation measures to benefit Indiana bats:

- In order to develop information on the Indiana bat, cooperate with the Service, MDC, NCRS and any other interested agency, to complete the 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 Columbia, Missouri Ecological Services Field Office by December 31 of each year.

- For successful implementation of the 2005 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 that tier to this programmatic biological opinion and the programmatic biological assessment. In addition, continue to conduct training for employees of the MTNF on bats occurring on the National Forest. Training should include sections on 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 2005 Forest Plan for the Mark Twain 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 MTNF action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the MTNF action is later modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operation causing such take must cease until reinitiation.