

United States Department of the Interior



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May 1, 2015

Mr. William B. Nightingale
Forest Supervisor
U.S. Forest Service
Mark Twain National Forest
401 Fairgrounds Rd.
Rolla, Missouri 65401

Subject: Biological Opinion on Ongoing Activities on the Mark Twain National Forest

Dear Mr. Nightingale:

This document transmits our final Biological Opinion based on our review of the U.S. Forest Service- Mark Twain National Forest (MTNF) ongoing projects that may impact the recently listed northern long-eared bat (NLEB) (*Myotis septentrionalis*) under section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your March 13, 2015 request for formal consultation was received on March 16, 2015. The Biological Opinion is based on information provided in the March 16, 2015 Biological Assessment, other available literature and information provided in the U.S. Fish and Wildlife Service's final rule of April 2, 2015, listing the northern long-eared bat as a threatened species that was published in the *Federal Register* (**80FR 17974**). A complete administrative record of this consultation is on file at this office.

The enclosed Biological Opinion addresses effects of ongoing projects involving species other than the northern long-eared bat for which your agency previously consulted on. Included in our analysis were 70 ongoing projects for which your agency made a "no effect" determination and 13 continuing projects where you concluded a "may affect, not likely to adversely affect" determination." We concur with your determinations on the 13 projects for which the Forest Service made a "may affect, not likely to adversely affect" determination."

This Biological Opinion covers those 39 projects for which the Fish and Wildlife Service (Service) concurred that they were likely to adversely affect the northern long-eared bat. This opinion provides a statement of anticipated incidental take as a result of these projects and associated reasonable and prudent measures, along with terms and conditions that will minimize the impact of anticipated take and contribute to the recovery of the northern long-eared bat.

After reviewing the status and environmental baseline of the northern long-eared bat and analysis of potential effects of the proposed actions to the species, it is our determination that these ongoing activities are not likely to jeopardize the continued existence of the northern long-eared bat.

In our final listing decision of April 2, 2015 (**80FR 17974**), the Service provided an interim 4(d) rule that allows for take exemption provided conservation measures are implemented that will aid in the conservation of the species. Activities for which take is exempted under the interim 4(d) rule include the following:

- (1) Take that is incidental to forestry management activities, maintenance/limited expansion of existing rights-of way, prairie management, projects resulting in minimal (<1 acre) tree removal, provided these activities:
 - a. Occur more than 0.25 mile (0.4 km) from a known, occupied hibernacula;
 - b. Avoid cutting or destroying known, occupied roost trees during the pup season (June 1–July 31); and
 - c. Avoid clearcuts (and similar harvest methods, *e.g.*, seed tree, shelterwood, and coppice) within 0.25 (0.4 km) mile of known, occupied roost trees during the pup season (June 1–July 31).
- (2) Removal of hazard trees (no limitations).
- (3) Purposeful take that results from
 - a. Removal of bats from and disturbance within human structures and
 - b. Capture, handling, and related activities for northern long-eared bats for 1 Year following publication of the interim rule.

Thus, any take of northern long-eared bat occurring in conjunction with these activities that complies with the conservation measures, as necessary, is exempted from section 9 prohibitions by the 4(d) rule, and does not require incidental take authorization. In your biological assessment dated March 16, 2015, you noted that your agency will be able to implement all these conservation measures except for some activities that will occur within 0.25 mi. of northern long-eared bat hibernacula. Consequently, these actions are not exempted under the interim 4(d) rule and are covered under the incidental take statement in the enclosed Biological Opinion. Note that in the incidental take statement, we acknowledge that both exempted and non-exempted take could occur (see Table 8). In addition to the conservation actions outlined in the project description, we are providing additional measures that will minimize the impact of the take not exempted under the 4(d) rule and contribute to the recovery of the northern long-eared bat.

If you have any questions or concerns regarding this consultation and Biological Opinion, please contact Paul McKenzie of this office at 573/234-2132, extension 107.

Sincerely,



Amy Salveter
Field Supervisor

Enclosure

BIOLOGICAL OPINION

Effects to the
Northern Long-eared Bat
From ongoing activities on the
Mark Twain National Forest
Missouri

Prepared by:
U.S. Fish and Wildlife Service
Columbia, Missouri Ecological Services Field Office

April 2015

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INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) based on our review of the U.S. Forest Service's (USFS) proposed activities on the Mark Twain National Forest, and their effects on the northern long-eared bat (*Myotis septentrionalis*; NLEB) in accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The USFS' March 13, 2015 request for formal consultation was received on March 16, 2015, along with the Biological Assessment (BA) on the proposed activities on the Mark Twain National Forest (MTNF). A complete consultation history can be found in Appendix A. The USFS determined that all activities addressed in the BA have had prior coordination/consultation for all other involved federally-listed species. Therefore, this BO addresses one species, the NLEB.

Some activities that occur on the MTNF also involve actions by other federal agencies, such as the U.S. Army Corps of Engineers (Corps) permitting under Section 404 of the Clean Water Act. In accordance with 50 CFR § 402.07, the USFS is taking the consultation lead for all activities on the MTNF. Any activities covered by a Corps permit(s) will not result in any impacts to NLEB beyond those addressed in this BO. Therefore, the Service intends to provide a copy of this BO to the Corps to demonstrate that the USFS has fulfilled its obligations to consult with the Service.

This BO is based on information provided in the BA and a review of gray and published literature on the life history requirements of NLEB. A complete administrative record of this consultation is on file at the Service's Columbia, Missouri Ecological Services Field Office at 101 Park DeVille Dr., Suite A, Columbia, Missouri 65203.

Interim 4(d) rule for the northern long-eared bat

On April 2, 2015, the Service has published a species-specific rule pursuant to section 4(d) of the ESA for northern long-eared bat (**80FR 17974**; U.S. Fish and Wildlife Service 2015). Section 4(d) of the ESA states that:

Whenever any species is listed as a threatened species ... the Secretary shall issue such regulations as he deems necessary and advisable to provide for the conservation of such species (16 U.S.C. 1533(d)).

The Service's 4(d) rule for northern long-eared bat exempts the take of northern long-eared bat from the section 9 prohibitions of the ESA, as follows:

- (1) Take that is incidental to forestry management activities, maintenance/limited expansion of existing rights-of way, prairie management, projects resulting in minimal (<1 acre) tree removal, provided these activities:
 - a. Occur more than 0.25 mile (0.4 km) from a known, occupied hibernacula;

- b. Avoid cutting or destroying known, occupied roost trees during the pup season (June 1–July 31); and
 - c. Avoid clearcuts (and similar harvest methods, *e.g.*, seed tree, shelterwood, and coppice) within 0.25 (0.4 km) mile of known, occupied roost trees during the pup season (June 1–July 31).
- (2) Removal of hazard trees (no limitations).
- (3) Purposeful take that results from
- a. Removal of bats from and disturbance within human structures and
 - b. Capture, handling, and related activities for northern long-eared bats for 1 Year following publication of the interim rule.

Thus any take of northern long-eared bat occurring in conjunction with these activities that complies with the conservation measures, as necessary, is exempted from section 9 prohibitions by the 4(d) rule, and does not require incidental take authorization. We distinguish these activities from other actions throughout the accompanying BO.

However, 4(d) rules do not afford exemption from the ESA's section 7 procedural requirements. Therefore, consultation remains appropriate when actions (even those within the scope of a 4(d) rule) are funded, authorized or carried out by a federal agency. This is because the purpose of section 7 consultation is broader than the mere evaluation of take and issuance of an Incidental Take Statement; such consultations fulfill the requirements of section 7(a)(2) of the ESA, which directs that all Federal actions insure that their actions are not likely to jeopardize the continued existence of any listed species, or result in the destruction or adverse modification of designated critical habitat.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

As defined in the ESA Section 7 regulations (50 CFR 402.02), “action” means “all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas.” The “action area” is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” The direct and indirect effects of the actions and activities must be considered in conjunction with the effects of other past and present Federal, State, or private activities, as well as the cumulative effects of reasonably certain future State or private activities within the action area.

The USFS reviewed all their ongoing actions and determined that a total of 39 projects were likely to continue beyond the time when the NLEB was listed. They then reviewed these projects, including their previous consultation documents, to determine how these projects would affect the NLEB. The USFS included conservation measures to minimize potential adverse impacts of various activities as part of their project description. The Service has analyzed the

effects of the proposed actions considering that the projects will be implemented as proposed (including all conservation measures).

The following project background and area descriptions are summarized from the BA. Additional information on MTNF background and description can be found in the BA and is incorporated by reference.

Projects/Actions that Will Have No Effect or Are Not Likely to Adversely Affect the NLEB

Seventy projects involved no tree clearing and/or no removal of vegetation, and would not alter the suitability any potential NLEB habitat, including known NLEB hibernacula or any cave habitats. These projects consisted of livestock grazing and hay allotments; special use permits for research (none of these involve tree removal); and feral hog control (Table 1). A full list and description of these activities are found in the MTNF Biological Assessment received March 16, 2015. The USFS determined that these projects would have no effect on the NLEB. The Service concurs with this determination.

The USFS determined that 13 project categories are not likely to adversely to affect the NLEB (Table 2). These include the following projects: non-native invasive plant species control; land exchanges; West Fork bottomland hardwood restoration; non-research special use permits; old growth designations; vernal pool construction, and mineral lease drilling. The Service concurs with this determination. Details of each project category are outlined below:

- Non-Native Invasive Plant (NNIP) Species control may occur on up to 3000 acres across the Forest annually. Methods that may be used to control NNIP species include chemical (herbicides), mechanical, manual, cultural controls, and biological control. The only NNIP tree species large enough to perhaps provide suitable habitat for NLEB is tree of heaven (*Ailanthus altissima*). This invasive species has never been documented as being used by NLEB for roosting. The use of mechanical equipment could result in some localized noise disturbances but probably not at levels that would cause bats to flee an area. Several design criteria were developed to eliminate or minimize effects from all methods that may be used to control NNIP to listed or sensitive species and can be found in the NNIP EIS (USDA 2012). Eradicating or controlling NNIP will benefit the bat by allowing native vegetation to grow in its place.
- There are two on-going land exchanges that have not been completed at this time. Both land exchanges are swapping parcels of federal land for better or equivalent non-Federal land and will consolidate Federal ownership patterns. Habitat for NLEB exists on all tracts. One tract the Forest Service will receive in exchange has a cave on it that may be suitable for bats.
- West Fork Bottomland Hardwood Restoration: This project is being proposed to: (1) restore the hydrology of the West Fork Black River bottomland area and (2) to restore springs within the area to a natural flow. Restoring the hydrology of this area will help to increase the diversity of plants, insects, birds, and mammals. In the past, springs were dammed and ditched to dry out the area to make it suitable for farming. Restoring a more

natural flow of these springs will help support bottomland hardwoods, ephemeral wetlands, emergent wetlands, wet-meadows, and forested wetlands. These wetlands would provide habitat for several species of plants and animals including the federally

Table 1. Ongoing projects for which the Forest Service made a “no effect” determination for NLEB (data courtesy U.S. Forest Service- Mark Twain National Forest- March 2015).

Project name	Location (Ranger District)
Wrinkle Springs Allotment (allotment= grazing unless otherwise specified).	Houston-Rolla-Cedar Creek
Roby Lake Allotment	Houston-Rolla-Cedar Creek
Dry Branch Allotment	Houston-Rolla-Cedar Creek
Boiling Springs Allotment	Houston-Rolla-Cedar Creek
High Log Way Allotment	Houston-Rolla-Cedar Creek
Winnipeg Allotment	Houston-Rolla-Cedar Creek
Gasconade Island Allotment	Houston-Rolla-Cedar Creek
Slabtown Allotment	Houston-Rolla-Cedar Creek
Tie Slide Allotment	Houston-Rolla-Cedar Creek
Beulah Allotment	Houston-Rolla-Cedar Creek
Pocket Eddy Allotment	Houston-Rolla-Cedar Creek
Vessie Allotment	Houston-Rolla-Cedar Creek
Gasconade Allotment	Houston-Rolla-Cedar Creek
Ross Bridge Allotment	Houston-Rolla-Cedar Creek
Allotment 0101	Houston-Rolla-Cedar Creek
Allotment 0102	Houston-Rolla-Cedar Creek
Allotment 0103	Houston-Rolla-Cedar Creek
Allotment 0104	Houston-Rolla-Cedar Creek
Allotment 0105	Houston-Rolla-Cedar Creek
Allotment 0106	Houston-Rolla-Cedar Creek
Allotment 0201	Houston-Rolla-Cedar Creek
Allotment 0202	Houston-Rolla-Cedar Creek
Allotment 0203	Houston-Rolla-Cedar Creek
Allotment 0204	Houston-Rolla-Cedar Creek
Allotment 0205	Houston-Rolla-Cedar Creek
Allotment 0301	Houston-Rolla-Cedar Creek
Allotment 0401	Houston-Rolla-Cedar Creek
Allotment 0501	Houston-Rolla-Cedar Creek
Allotment 0502	Houston-Rolla-Cedar Creek
Allotment 0503	Houston-Rolla-Cedar Creek

Project name	Location (Ranger District)
Allotment 0601	Houston-Rolla-Cedar Creek
Allotment 0701	Houston-Rolla-Cedar Creek
Allotment 0702	Houston-Rolla-Cedar Creek
Allotment 0801	Houston-Rolla-Cedar Creek
Allotment 0802	Houston-Rolla-Cedar Creek
Allotment 0901	Houston-Rolla-Cedar Creek
Allotment 1001	Houston-Rolla-Cedar Creek
Allotment 1101	Houston-Rolla-Cedar Creek
Allotment 1401	Houston-Rolla-Cedar Creek
Allotment 1501	Houston-Rolla-Cedar Creek
Allotment 1502	Houston-Rolla-Cedar Creek
Allotment 1601	Houston-Rolla-Cedar Creek
Allotment 1701	Houston-Rolla-Cedar Creek
Allotment 1901	Houston-Rolla-Cedar Creek
Allotment 2001	Houston-Rolla-Cedar Creek
Allotment 2101	Houston-Rolla-Cedar Creek
Black River 1 Allotment	Poplar Bluff
Asher Creek Allotment	Salem
Barney Fork Allotment	Salem
Casey Allotment	Salem
Buttram Allotment	Ava-Cassville-Willow Springs
Mark Twain Allotment	Ava-Cassville-Willow Springs
Weeks Allotment	Ava-Cassville-Willow Springs
Sorg Allotment	Ava-Cassville-Willow Springs
Oremus Allotment	Ava-Cassville-Willow Springs
West Fork Big Creek Allotment	Ava-Cassville-Willow Springs
Brushy Creek Allotment	Ava-Cassville-Willow Springs
Little Yoeman Allotment	Ava-Cassville-Willow Springs
76 HWY Allotment	Ava-Cassville-Willow Springs
Middle Indian Creek Allotment	Ava-Cassville-Willow Springs
Round Valley East Allotment	Ava-Cassville-Willow Springs
Elevation 1097 Allotment	Ava-Cassville-Willow Springs
Mt. Ararat Allotment	Ava-Cassville-Willow Springs
Shaggy Coyote Allotment	Ava-Cassville-Willow Springs
Dry Creek Allotment	Ava-Cassville-Willow Springs
Big Barren Allotment	Eleven Point
Copenhagen Allotment	Eleven Point
Hay / Wildlife Allotments	Forest Wide (48 total)
Research Special Use Permits	Forest Wide
Feral Hog Control	Forest Wide

Table 2. Projects for which the Service concurs with a “may affect, not likely to adversely affect” determination for NLEB.

Project Name	Location (Ranger District)
Non-native invasive plant species control in various project areas	Forest Wide
TNC Land Exchange	Ava-Cassville- Willow Springs and Eleven Point
Laramore Land Exchange	Potosi
West Fork Bottomlands Restoration	Salem
Special Use Permits (non-research) (list available upon request).	Forest Wide
Old Growth Designations	Forest Wide
Vernal Pool Construction (no-timber removal)	Forest Wide
Shoal Creek Aquatic Organism Passage project	Potosi
Silver Mines Gate Installation	Potosi
23 Degree Cave and Coldwater Springs Cave Gating	Potosi
Brickey Slab Aquatic Organism Passage project	Potosi
East Fredericktown Fen Restoration Project	Potosi
Bunker Area/Derecho Fuels Project	Salem

endangered Hine’s emerald dragonfly, gray bat, and Indiana bat, and the recently listed northern long-eared bat. All Forest Plan standards and guidelines will be adhered to, including hazard tree removal dates. Previously, the Service concurred that this project would not likely to adversely affect the Indiana bat. The project may beneficially affect the species by creating more suitable conditions in the riparian area and in stream (improved water quantity/quality).

- Non-research Special Use Permits. The MTNF is administering 1,112 special use permits for various activities ranging from campground/concessionaires, access easements, to rights’-of ways and pipelines. Most (if not all) of the tree clearing activities for these projects have already been accomplished. All special use permits must adhere to Forest Service standards and guidelines for northern long-eared bat. The ongoing activity associated with these activities involves permit administration.

- Old growth designations. The 2005 Forest Plan Objective 1.4e is to “Designate permanent old growth on 8% to 12% of each 2.1 and 6.2 management area, and on 15-20% of each 6.1 management area.” As outlined in the Standards and Guidelines (noted above), the 20 acre area around a hibernacula is to be managed as old growth forest. The designation is not likely to adversely affect NLEB.
- A component of many larger vegetation management projects is the construction of vernal pools which does not entail any tree removal. These pools are usually constructed at the end of logging roads once the project is completed. These vernal pools may benefit bats by providing water and a potential prey base (i.e., aquatic insects).
- Cave gating projects at Silver Mines, 23 Degree Cave and Coldwater Springs Cave are ongoing and will be implemented as funding allows. All cave gates will be constructed using bat friendly techniques and will be conducted during a period when there will be no impacts to hibernating bats.
- The Bunker Area/Derecho fuels project has 4,728 acres that remains to be treated. This area was impacted by straight-line winds and involves the removal of downed trees. No standing trees will be removed with the implementation of this project and therefore is not likely to adversely affect NLEB.

Previous consultations with the Service had concluded that these projects were also not likely to adversely affect the Indiana bat. None of these projects involved any potential effects to known NLEB hibernacula or any cave habitats, so none will be affected. As a result, the Service concurs that these projects are not likely to adversely affect the NLEB.

No further consultation or coordination under the ESA is required for the above-listed projects that will have no effect or are not likely to adversely affect the NLEB. Should project plans change, or if additional information on listed and proposed species become available, this determination will be reevaluated.

Ongoing Projects/Actions that Are Likely to Adversely Affect the NLEB

The USFS determined that 39 ongoing projects are likely to adversely to affect the NLEB [as listed in Table 3 below]. All these projects involve prescribed fire in forested areas and/or tree removal outside the hibernation period, and thus have the potential to adversely affect roosting and/or foraging habitat for the NLEB. Many of these projects were initiated several years ago and as a result are largely completed, while some projects have just recently initiated implementation.

Table 3. Projects for which the Service concurs with a “may affect, likely to adversely affect” determination for NLEB (data courtesy U.S. Forest Service- Mark Twain National Forest- March 2015).

Project Name	Location (Ranger District)	Project Type	# acres left to be implemented	# miles left to be implemented
Brushy Creek and Clayton Ridge Project	Ava-Cassville-Willow Springs	Timber Removal	2663	
Cane Ridge East	Poplar Bluff	Timber Removal	1700	
Cane Ridge West	Poplar Bluff	Timber Removal	3956	
Carson Hill Salvage Project	Poplar Bluff	Timber Removal	240	
Crescent II Project	Houston-Rolla- Cedar Creek	Timber Removal	3355	
Blue Hole Project	Ava-Cassville-Willow Springs	Timber Removal	1205	
Turnip Knob Project	Ava-Cassville-Willow Springs	Timber Removal	1229	
East Fredericktown Project	Potosi	Timber Removal	3750	
Fairview Project	Houston-Rolla- Cedar Creek	Timber Removal	3899	
Garrison Ridge Project	Ava-Cassville-Willow Springs	Timber Removal	2171	
Greasy Creek Project	Ava-Cassville-Willow Springs	Timber Removal	1781	
Handy Natural Community Restoration Project	Eleven Point	Timber Removal	6302	
Kaintuck West Project (includes large woody debris project at Mill Creek)	Houston-Rolla- Cedar Creek	Timber Removal	8504	
Kelly Valley Salvage Project	Poplar Bluff	Timber Removal	45	
Lynchburg Project	Houston-Rolla- Cedar Creek	Timber Removal	8011	

Project Name	Location (Ranger District)	Project Type	# acres left to be implemented	# miles left to be implemented
Medley Hollow Project	Salem	Timber Removal	4278	
Possum Trot Project	Eleven Point	Timber Removal	1814	
Shirley Project	Potosi	Timber Removal	11717	
Shoal Creek Project	Potosi	Timber Removal	3837	
Southard Project	Houston- Rolla- Cedar Creek	Timber Removal	561	
Teasley Hollow Project	Houston- Rolla- Cedar Creek	Timber Removal	3080	
Van Buren Project	Eleven Point	Timber Removal	6729	
Westside Project	Eleven Point	Timber Removal	3151	
Hickory Creek Salvage Project	Poplar Bluff	Timber Removal	12	
Cattail Creek Salvage Project	Poplar Bluff	Timber Removal	28	
Indian Creek Project	Ava-Cassville- Willow Springs	Timber Removal	5110	
Boiling Springs Project	Houston- Rolla- Cedar Creek	Timber Removal	7749	
Fremont Project	Eleven Point	Timber Removal	16472	
Ava Glades East – Cedar Removal (near NLEB cave)	Ava-Cassville- Willow Springs	Cedar Removal	4	
Kaintuck West –Cedar Removal (near NLEB cave)	Houston- Rolla- Cedar Creek	Cedar Removal	1	
North Fork Boat Access	Ava-Cassville- Willow Springs	Timber Removal	3	
Hoskins Logging Rd	Eleven Pt.	Access Rd.	0.4	

Project Name	Location (Ranger District)	Project Type	# acres left to be implemented	# miles left to be implemented
Prescribed Burning Projects (specific project names/burn plans may be requested)	Forest Wide	Prescribed Burning	Approx. up to 50,000 acres annually	Up to 240 (fire line construction annually)
Trail Maintenance	Forest Wide	Individual tree removal may be associated with trail maintenance		Up to 500
Recreation Site Maintenance	Forest Wide	Individual tree removal may be associated with these activities	Up to 1500	
Road Maintenance/Reconstruction	Forest Wide	Individual tree removal may be associated with these activities		Up to 25
Road Decommissioning	Forest Wide	Individual tree removal may be associated with these activities		Up to 30
Pond Brushing and Other Wildlife Habitat Improvements not included in larger vegetation management projects	Forest Wide	Individual tree removal may be associated with these activities	Approx. 12 acres annually	
Temporary Road Construction & skid trails	Forest Wide	Individual tree removal may be associated with these activities	Up to 800	
Mineral Lease Drilling	Salem	Individual tree removal may be associated with these activities	Up to 10 annually	
Total Maximum Acres/Miles*	Forest Wide		165,701	795

* The vegetation management projects (timber removal) would not be implemented all in one year. Some projects would be accomplished in the next year, while others may be implemented within the next 10 years, depending on when a formal Forest Service Decision is/was signed. The acres or miles for prescribed fire and road and recreation activities is the maximum (annually) allowable per the Incidental Take Statement for Indiana bats in the Programmatic Biological Opinion the Service issue to the Forest Service in 2005 (see Appendix A).

Table 4. Projects that may affect northern long-eared bats within 1/4 mile buffer around hibernacula (data courtesy U.S. Forest Service- Mark Twain National Forest- March 2015).

Project Name	Location (Ranger District)	Project Type	#acres left to be implemented
Ava Glades East	Ava-Cassville-Willow Springs	Cedar removal	4
Ava Glades East	Ava-Cassville-Willow Springs	Hardwood thinning	10
Kaintuck West	Houston-Rolla- Cedar Creek	Cedar removal	9
Kaintuck West	Houston-Rolla- Cedar Creek	Midstory Control	24
Kaintuck West	Houston-Rolla- Cedar Creek	Pine thinning	15
Kaintuck West	Houston-Rolla- Cedar Creek	Precommercial thinning	4
Fremont	Eleven Point	Precommercial thinning	13
Fremont	Eleven Point	Commercial thinning	14
Fremont	Eleven Point	Restoration thinning	57
Fremont	Eleven Point	Salvage	6
Van Buren	Eleven Point	Precommercial Thinning	39
Van Buren	Eleven Point	Salvage	22
Shoal Creek	Potosi	Crop Tree Release	6
Mineral Leases	Salem	Tree Removal for Drilling	115
Totals			338

Thirty-nine ongoing projects will involve timber removal or areas managed by prescribed fire. A total of 165,924 acres could be impacted. This would include potential impact of tree removal associated with 795 miles of constructed fire lines, trail maintenance, road

maintenance/reconstruction, road decommissioning, or mineral exploration. Implementation of conservation measures 1b and 1c in the Service's interim 4-d rule above and additional conservation actions below would reduce any potential adverse effects.

Much of the prescribed burning that occurs on the MTNF occurs during the hibernation period, however some burns could be conducted during migration or the swarming and staging period. No burning would occur in the 20 acre old growth area and the 130 acre mature forest area around any hibernacula during the swarming and staging periods. All caves are considered smoke-sensitive areas and burn plans would be written to minimize or eliminate smoke into the caves. Burns conducted while bats are migrating could cause them to arouse and move to a different area. The effect would be short-term and localized and mortality is not expected. Although it is authorized in the 2005 Forest Plan, none of the "on-going" prescribed burning projects will be burned in the maternity season.

The USFS and the Service previously concluded that some of these projects were also likely to adversely affect the Indiana bat and completed Tier-II formal consultations on these projects under the programmatic BO of 2005 (see Appendix A). The dates of these previous consultations are provided in Appendix B. Previous consultation documents provided full descriptions of the proposed actions for each of these projects, and are incorporated herein by reference.

The Service concurs that these 39 projects are likely to adversely affect the NLEB and in the remainder of this BO, we will address the potential impacts of these activities. In conducting our analysis, we will look at the potential impact of actions for all 165,924 acres where timber removal and prescribed fire are planned.

Conservation Measures

Conservation measures are those actions taken to benefit or promote the recovery of the species. These actions taken by the federal agency or the applicant that serve to minimize or compensate for project effects on the species under review and are included as an integral portion of the proposed action.

To be in compliance with the interim 4(d) rule for NLEB that the Service published on April 2, 2015, the USFS has committed to the following conservation measures as part of the project description:

- 1) Most proposed activities will occur more than 0.25 mile (0.4 km) from a known, occupied hibernaculum. While the Forest Service has agreed to embrace this recommendation for future consultations involving NLEB, the current consultation involves ongoing projects to which this stipulation is agreed to, in part.
- 2) The USFS will avoid cutting or destroying known, occupied roost trees during the pup season (June 1–July 31).

3) The USFS will avoid clearcuts (and similar harvest methods, *e.g.*, seed tree and shelterwood) within 0.25 (0.4 km) mile of known, occupied roost trees during the pup season (June 1–July 31).

Following formal consultation with the Service and the issuance of the 2005 Programmatic Biological Opinion, the Forest Service amended their land resource management plan to incorporate multiple conservation measures that would benefit federally listed bats (U.S. Forest Service 2014, Chapter 2). Many of these measures include proactive actions to benefit hibernacula and summer habitat and they would benefit NLEBs as well as Indiana bats. Highlights of additional conservation measures being implemented by the Forest Service to benefit the NLEB include:

- Designate an area of at least 20 acres completely surrounding a threatened, endangered, candidate, proposed, or rare species of 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.
- Maintain an additional 130 acres of mature forest or mature woodland around each occupied threatened, endangered, candidate, proposed, or rare species of bat cave.
- The area around occupied threatened, endangered, candidate, proposed, or rare species of 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.
- 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.
- Prohibit removal of suitable roost trees and prescribed burning within the 20 acres of old growth and 130 acres of forest or mature woodland surrounding a threatened, endangered, candidate, proposed, or rare species of bat hibernacula during the swarming and staging periods. Determine dates individually for each cave (normally between September 1 and November 1 and between March 15 and April 30, respectively).
- 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.
- Remove hazard trees between November 1 and April 1 whenever possible.

- 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.
- All even-aged regeneration harvests shall retain at least 7%-10% of the harvest unit in reserve trees and/or reserve tree groups.
- Reserve trees and reserve tree groups should include a combination of the following: The largest, long-lived species occurring on the site [short-leaf pine (*Pinus echinata*), white oak (*Quercus alba*), post oak (*Q. stellate*), hickory (*Carya* spp), black gum (*Nyssa sylvatica*)]; standing dead trees; and cavity or den trees.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action. For the purposes of this BO, the action area includes the portions of the Mark Twain National Forest for which ongoing activities are being implemented. For some projects where the Service concurs with a may affect, not likely to adversely affect determination, this would include the entire MTNF. The federally owned lands are interspersed with other private and state owned lands within the 1,500,000 acres contained within the MTNF's proclamation boundary. The MTNF is located primarily in Barry, Boone, Butler, Callaway, Carter, Christian, Dent, Douglas, Howell, Iron, Madison, Oregon, Ozark, Phelps, Pulaski, Ripley, Shannon, Stone, Taney, Texas, Washington, and Wayne Counties. For other ongoing projects that involve prescribed fire or timber removal activities, it would include the areas outlined in Tables 1 and 2. This would total 165,924 acres and would include tree removal associated with the construction of 795 miles of fire lines, trail maintenance, road maintenance/reconstruction, road decommissioning, or mineral exploration.

STATUS OF THE SPECIES

Refer to the final rule (**80FR 17974**; U.S. Fish and Wildlife Service 2015) for the best available information on NLEB life history and biology, threats, distribution and overall status. The following is information obtained from that rule and information gleaned from referenced published and gray literature.

Life History and Biology

Summer habitat and ecology

Suitable summer habitat¹ for NLEB consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts, as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure.

Many species of bats, including the NLEB, consistently avoid foraging in or crossing large open areas, choosing instead to use tree-lined pathways or small openings (Patriquin and Barclay 2003, Yates and Muzika 2006). Further, wing morphology of both species suggests that they are adapted to moving in cluttered habitats. Thus, isolated patches of forest may not be suitable for foraging or roosting unless the patches are connected by a wooded corridor.

Upon emergence from the hibernacula in the spring, females seek suitable habitat for maternity colonies. Coloniality and social cohesion is a requisite behavior for reproductive success (Garroway and Broders 2007; Patriquin et al. 2010). NLEB maternity colonies range widely in size, although 30-60 may be most common (Foster and Kurta 1999; Sasse and Perkins 1996; Service 2013). NLEB show some degree of inter-annual fidelity to single roost trees and/or maternity areas (Broders et al. 2006). Unlike Indiana bats, male NLEB are routinely found with females in maternity colonies. NLEB use networks of roost trees often centered around one or more central-node roost trees (Johnson et al. 2012). NLEB roost networks also include multiple alternate roost trees and male and non-reproductive female NLEB may also roost in cooler places, like caves and mines (Barbour and Davis 1969, Amelon and Burhans 2006). Timpone et al. (2010) noted that NLEBs tend to use forest with a higher canopy cover and roost in cavities and live trees more often than Indiana bats. Silvis et al. (2015a) studied day-roosts used by female northern long-eared bats for two years and determined that roost use in both years were larger, in later stages of decay, and in relatively more open canopies than randomly selected non-roosts.

NLEB roost in cavities, underneath bark, crevices, or hollows of both live and dead trees and/or snags (typically ≥ 3 inches dbh). NLEB are known to use a wider variety of roost types, using tree species based on presence of cavities or crevices or presence of peeling bark. NLEB have also been occasionally found roosting in structures like barns and sheds (particularly when suitable tree roosts are unavailable).

Young NLEB are typically born in late-May or early June, with females giving birth to a single offspring. Lactation then lasts 3 to 5 weeks, with pups becoming volant (able to fly) between early July and early August.

Migration

¹ See the Service's current summer survey guidance for our latest definitions of suitable habitat available at: <http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html>. While this guidance was developed for Indiana bat, it can be used for the Northern long-eared bat as well.

Males and non-reproductive females may summer near hibernacula, or migrate to summer habitat some distance from their hibernaculum. NLEB is not considered to be a long distance migrant (typically 40-50 miles). Migration is an energetically demanding behavior for the NLEB, particularly in the spring when their fat reserves and food supplies are low and females are pregnant.

Winter habitat and ecology

Suitable winter habitat (hibernacula) includes underground caves and cave-like structures (e.g. abandoned or active mines, railroad tunnels). Generally, NLEB hibernate from October to April depending on local weather conditions (November-December to March in southern areas and as late as mid-May in some northern areas).

Hibernacula for NLEB typically have significant cracks and crevices for roosting; relatively constant, cool temperatures (0-9 degrees Celsius) and with high humidity and minimal air currents. Specific areas where they hibernate have very high humidity, so much so that droplets of water are often seen on their fur. Within hibernacula, surveyors find them in small crevices or cracks, often with only the nose and ears visible.

NLEB tend to roost singly or in small groups (U.S. Fish and Wildlife Service 2015), with hibernating population sizes ranging from a just few individuals to around 1,000 (U.S. Fish and Wildlife Service unpublished data). NLEB display more winter activity than other cave species, with individuals often moving between hibernacula throughout the winter (Griffin 1940, Whitaker and Rissler 1992, Caceres and Barclay 2000). NLEB have shown a high degree of philopatry to the hibernacula used, returning to the same hibernacula annually.

Spring Staging and Fall Swarming habitat and ecology

Upon arrival at hibernacula in mid-August to mid-November, NLEB “swarm,” a behavior in which large numbers of bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in caves during the day. Swarming continues for several weeks and mating occurs during the latter part of the period. After mating, females enter directly into hibernation but not necessarily at the same hibernaculum as they had been mating at. A majority of bats of both sexes hibernate by the end of November (by mid-October in northern areas).

After hibernation ends in late March or early April (as late as May in some northern areas), most NLEB migrate to summer roosts. Females emerge from hibernation prior to males. Reproductively active females store sperm from autumn copulations through winter. Ovulation takes place after the bats emerge from hibernation in spring. The period after hibernation and just before spring migration is typically referred to as “staging,” a time when bats forage and a limited amount of mating occurs. This period can be as short as a day for an individual, but not all bats emerge on the same day.

In general, NLEB use roosts in the spring and fall similar to those selected during the summer. Suitable spring staging/fall swarming habitat consists of the variety of forested/wooded habitats where they roost, forage, and travel, which is most typically within 5 miles of a hibernaculum. This includes forested patches as well as linear features such as fencerows, riparian forests and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Isolated trees are considered suitable habitat when they exhibit the characteristics of a suitable roost tree and are less than 1,000 feet from the next nearest suitable roost tree, woodlot, or wooded fencerow.

Threats

No other threat is as severe and immediate for the NLEB and the Indiana bat as the disease white-nose syndrome (WNS). Although Indiana bat populations have been imperiled for decades, it is unlikely that NLEB populations would be declining so dramatically without the impact of WNS. Since the disease was first observed in New York in 2006, WNS has spread rapidly in bat populations from the Northeast to the Midwest and the Southeast. Population numbers of NLEB have declined by 99 percent in the Northeast, which along with Canada, has been considered the core of the species' range. WNS-related declines in Indiana bat populations are estimated at up to 75 percent, with the disease recently moving into the Midwest core of the species range. Although there is uncertainty about how quickly WNS will spread through the remaining portions of these species' ranges, it is expected to spread throughout their entire ranges. In general, the Service believes that WNS has significantly reduced the redundancy and resiliency of both the NLEB and Indiana bat.

Although significant NLEB population declines have only been documented due to the spread of WNS, other sources of mortality could further diminish the species' ability to persist as it experiences ongoing dramatic declines. Specifically, declines due to WNS have significantly reduced the number and size of NLEB populations in some areas of its range. This has reduced these populations to the extent that they may be increasingly vulnerable to other stressors that they may have previously had the ability to withstand. These impacts could potentially be seen on two levels. First, individual NLEB sickened or struggling with infection by WNS may be less able to survive other stressors. Second, NLEB populations impacted by WNS, with smaller numbers and reduced fitness among individuals, may be less able to recover making them more prone to extirpation. The status and potential for these impacts will vary across the range of the species.

Bats affected but not killed by WNS during hibernation may be weakened by the effects of the disease and may have extremely reduced fat reserves and damaged wing membranes. These effects may reduce their capability to fly or to survive long-distance migrations to summer roosting or maternity areas. Affected bats may also be more likely to stay closer to their hibernation site for a longer time period following spring emergence.

In areas where WNS is present, there are additional energetic demands for northern long-eared

bats. For example, WNS-affected bats have less fat reserves than non-WNS-affected bats when they emerge from hibernation (Reeder et al. 2012; Warnecke et al. 2012) and have wing damage (Meteyer et al. 2009; Reichard and Kunz 2009) that makes migration and foraging more challenging. Females that survive the migration to their summer habitat must partition energy resources between foraging, keeping warm, successful pregnancy and pup-rearing, and healing and may experience reduced reproductive success. In addition, with wing damage, there may be an increased chance of WNS-affected bats being killed or harmed as a result of proposed action, particularly if timber harvest or burns are conducted early in the spring (April – May).

Over the long-term, sustainable forestry benefits NLEB by maintaining suitable habitat across a mosaic of forest treatments. However, forest practices can have a variety of impacts on the NLEB depending on the quality, amount, and location of the lost habitat, and the time of year of clearing. Depending on their characteristics and location, forested areas can function as summer maternity habitat, staging and swarming habitat, migration or foraging habitat, or sometimes, combinations of more than one habitat type. Impacts from tree removal to individuals or colonies would be expected to range from indirect impact (e.g., minor amounts of forest removal in areas outside NLEB summer home ranges or away from hibernacula) to minor (e.g., largely forested areas, areas with robust NLEB populations) to significant (e.g., removal of a large percentage of summer home range, highly fragmented landscapes, areas with WNS impacts).

Lastly, there is growing concern that bats, including the NLEB (and other bat species) may be threatened by the recent surge in construction and operation of wind turbines across the species' range. Mortality of NLEB has been documented at multiple operating wind turbines/farms. The Service is now working with wind farm operators to avoid and minimize incidental take of bats and assess the magnitude of the threat.

Rangewide Status

The NLEB ranges across much of the eastern and north central United States, and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993; Caceres and Pybus 1997; Environment Yukon 2011). In the United States, the species' range reaches from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east through the Gulf States to the Atlantic Coast (Whitaker and Hamilton 1998; Caceres and Barclay 2000; Wilson and Reeder 2005, p. 516, Amelon and Burhans 2006). The species' range includes the following 37 States (plus the District of Columbia): Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming. Historically, the species has been most frequently observed in the northeastern United States and in Canadian Provinces, Quebec and Ontario, with sightings increasing during swarming and hibernation (Caceres and Barclay 2000). However, throughout the majority of the species' range it is patchily distributed, and

historically was less common in the southern and western portions of the range than in the northern portion of the range (Amelon and Burhans 2006).

Although they are typically found in low numbers in inconspicuous roosts, most records of NLEB are from winter hibernacula surveys (Caceres and Pybus 1997). More than 780 hibernacula have been identified throughout the species' range in the United States, although many hibernacula contain only a few (1 to 3) individuals (Whitaker and Hamilton 1998). Known hibernacula (sites with one or more winter records of northern long-eared bats) include: Alabama (2), Arkansas (41), Connecticut (8), Delaware (2), Georgia (3), Illinois (21), Indiana (25), Kentucky (119), Maine (3), Maryland (8), Massachusetts (7), Michigan (103), Minnesota (11), Missouri (more than 270), Nebraska (2), New Hampshire (11), New Jersey (7), New York (90), North Carolina (22), Oklahoma (9), Ohio (7), Pennsylvania (112), South Carolina (2), South Dakota (21), Tennessee (58), Vermont (16), Virginia (8), West Virginia (104), and Wisconsin (67). NLEB are documented in hibernacula in 29 of the 37 States in the species' range. Other States within the species' range have no known hibernacula (due to no suitable hibernacula present, lack of survey effort, or existence of unknown retreats).

The current range and distribution of NLEB must be described and understood within the context of the impacts of WNS. Prior to the onset of WNS, the best available information on NLEB came primarily from surveys (primarily focused on Indiana bat or other bat species) and some targeted research projects. In these efforts, NLEB was very frequently encountered and was considered the most common myotid bat in many areas. Overall, the species was considered to be widespread and abundant throughout its historic range (Caceres and Barclay 2000).

WNS has been particularly devastating for NLEB in the northeast, where the species was believed to be the most abundant. There are data supporting substantial declines in NLEB populations in portions of the Midwest due to WNS. In addition, WNS has been documented at more than 100 NLEB hibernacula in the southeast, with apparent population declines at most sites. WNS has not been found in any of the western states to date and the species is considered rarer in the western extremes of its range. We expect further declines as the disease continues to spread across the species' range.

Status of the Northern Long-eared Bat in Missouri

Missouri records indicate that the northern long-eared bat hibernates mostly in the eastern and central Ozarks. However, they are widespread and have been recorded in approximately 270 hibernacula throughout the state. Hibernating individuals have been found in Missouri as far southwest as McDonald County and as far northeast as Marion County [Missouri Department of Conservation (MDC unpublished data)]. It is presumed that the northern long-eared bat occurs throughout most of Missouri during the summer. Mist net captures of the species have been reported from counties at or near all four corners of the state (Newton, Nodaway, Clark, and Cape Girardeau counties).

Critical Habitat

Critical habitat has not been proposed for the NLEB.

Conservation Needs of the Species

The species' conservation needs define what is needed in terms of reproduction, numbers, and distribution to ensure the species is no longer in danger of extinction. The conservation needs should be defined in the species' recovery outline or plan. Since there is no recovery plan or recovery outline available at this time, we will outline the conservation needs based on our current understanding of the species.

We find that the primary conservation need of the NLEB is to reduce the threat of WNS. This includes minimizing mortality in WNS-affected areas, and slowing the rate of spread into currently unaffected areas. In addition, NLEB that continue to exist within WNS-affected areas need to be able to continue to survive and reproduce in order to stabilize and/or increase the populations. This can be done by reducing the other threats to the species, as listed above. Therefore, efforts to protect hibernacula from disturbances need to continue. This should include restricting human access to hibernacula particularly during the hibernation period, constructing and maintaining appropriately designed gates, and restoring microhabitat conditions in hibernacula that have been altered. Efforts should also be made to protect and restore (in some cases) adequate fall swarming habitat around hibernacula. Known maternity habitat should be maintained, and the removal of known roost trees, particularly when pregnant females and/or young are present, should be reduced. Research to identify important hibernacula and summer areas and to delineate the migratory relationship between summering and wintering populations should also be pursued.

ENVIRONMENTAL BASELINE

The Environmental Baseline analyzes the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and the ecosystem within the action area.

Status of the Species on the MTNF:

The northern long-eared bat has been captured during mist netting efforts on every Ranger District on the MTNF. Since 1997, 510 mist-net sites have been surveyed across the Forest and of that, northern long-eared bats were captured at 299 sites (see Table 5). The mist-netting effort for northern long-eared bats at all survey sites on NFS lands on the MTNF is depicted in Table 6.

Table 5. Basic Occupancy Rate based on the number of mist-net sites surveyed and number that resulted in NLEB Captures on MTNF (data courtesy U.S. Forest Service- Mark Twain National Forest- March 2015).

Survey Year	Number of Mist-net Sites Surveyed	Number of Mist-net Sites where NLEB Captured	Rough Calculation of Occupancy Rate
1997	13	12	92%
1998	16	12	75%
2001	24	9	38%
2002	65	16	25%
2003	13	13	100%
2004	32	15	47%
2005	30	27	90%
2006	19	17	89%
2007	50	31	62%
2008	47	22	47%
2009	45	26	58%
2010	27	13	48%
2011	11	10	91%
2012	21	19	90%
2013	26	15	58%
2014	71	42	59%
16 year average			67%

Table 6. Mist-netting effort for NLEB at all survey sites on MTNF (data courtesy U.S. Forest Service- Mark Twain National Forest- March 2015).

Survey Year	Total # of NLEB Captured	# Mist-net Sites	# Mist-net Nights	Average # NLEB Captured Per Site	NLEB Captured per unit effort	NLEB Captured per UE (net night)
1997	49	13	26	3.77	0.14	1.88
1998	47	16	32	2.94	0.09	1.47
2001	37	24	38	1.54	0.04	0.97
2002	114	65	79	1.75	0.02	1.44
2003	22	13	13	1.69	0.13	1.69
2004	43	32	84	1.34	0.02	0.51
2005	445	30	30	14.83	0.49	14.83
2006	152	19	41	8.00	0.20	3.71
2007	28	4	13	7.00	0.54	2.15
2008	68	51	60	1.33	0.02	1.13
2009	101	45	86	2.24	0.03	1.17
2010	49	36	72	1.36	0.02	0.68

Survey Year	Total # of NLEB Captured	# Mist-net Sites	# Mist-net Nights	Average # NLEB Captured Per Site	NLEB Captured per unit effort	NLEB Captured per UE (net night)
2011	64	11	14	5.82	0.42	4.57
2012	182	21	23	8.67	0.38	7.91
2013	77	21	28	3.67	0.13	2.75
2014	221	49	129	4.51	0.03	1.71

Habitat Conditions in the Action Area

Habitat conditions on the MTNF remain approximately the same as described in the 2005 programmatic BA (U.S.D.A. 2005c). Overall, the MNF provides a large area of mature intact forest, interspersed with younger, managed forests and other habitat types. Approximately 95 percent of the MTNF is forested with a number of different forest types including a wide variety of species of bottomland and upland hardwoods ; some districts of the MTNF have a mixture of hardwoods and shortleaf pine. Over 50 percent of this forested habitat is in the greater than 80 year old age class. Most of the non-forested habitat consists of savannas, grassland, or aquatic habitats such as wetlands, ponds, streams, or fens. Karst geology and outcrops of cave-forming limestone formations are scattered throughout the MTNF, providing a number of known and potential hibernacula for the species. These conditions make the MTNF highly suitable for the NLEB, as reflected in the results of the survey efforts depicted in Tables 5 and 6 above. The NLEB typically uses mature, intact interior forest for roosting and foraging, though younger, managed forests are also used.

Winter hibernacula

There are 36 known hibernacula on the MTNF. Populations counts have not been done systematically or regularly, but rather, opportunistically, except for when done at Indiana bat hibernacula. Observed populations at these caves range from 1 to 276 bats. Three caves have observed hibernating populations over 50: IRN001, CTR101, and ORE007. Cave SGE054 also has a decent size population; however, this cave is on private lands immediately adjacent to the National Forest. The records of hibernating populations documented in caves after December 1 of a given year are summarized in Table 7. The remainder of the caves either had swarming or staging records from harp trapping and we assume some Northern long-eared bats hibernate in these caves. The species occurs on all but the Poplar Bluff Ranger District in the winter (there are no known hibernacula on that unit). There are undoubtedly more hibernating bats on the Forest, but no species specific monitoring has occurred on the MTNF's almost 700 caves and abandoned mines. As more surveys are done at other caves, the Forest Service predicts that the number of caves occupied by hibernating populations of Northern long-eared bats is likely to increase (U.S.D.A. 2015). Several caves on the MTNF have signs of White Nose Syndrome.

Summer habitat

The species occurs on every Ranger District on the MTNF during the summer (U.S. D.A. 2015). Northern long-eared bats are not dependent on a certain tree species for roosting but instead they

select trees that have suitable structure for roosting (i.e., trees that will form suitable cavities, cracks or retain bark) (U.S. Fish and Wildlife Service 2015). The MTNF has a diversity of habitats: 36% of oaks; 29% oak/hickory; 14% pine/oak; 9% pine; 5% openlands; and the rest of the habitats are cedar or other hardwoods. Given the large amount of forested land on the MTNF, there is an abundance of summer roosting and foraging habitat for the NLEB.

The MTNF consists of over 1.5 million acres in 29 counties in southern Missouri. These acres account for 3 percent of Missouri’s land area, and 11 percent of the State’s forested land. About 5% of the MTNF is in open lands (pasture, old fields, glades, warm-season grasslands) and 95% is in forest cover. The current composition of the MTNF is about 1% regenerating (0-10 years old); 18% young forest (11-50 years old); 45% mature forest (51-90 years old); and 36% old growth (91+ years old). 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. Since the implementation of the 2005 Forest Plan: 13,397 acres have been managed by commercial thinning; 1,128 acres of intermediate salvage; 29,180 acres of pre-commercial thinning and release; and 18,093 acres of regeneration cuts. From Fiscal Year 2006 to 2012, 61,798 acres were affected by timber harvest. (U.S.D.A. 2013). Levels of activities (i.e., prescribed fire acres and acres of other activities including timber harvest and other tree removal) that have occurred on the MTNF since the implementation of the 2005 Forest Plan are represented in Figure 1 below.

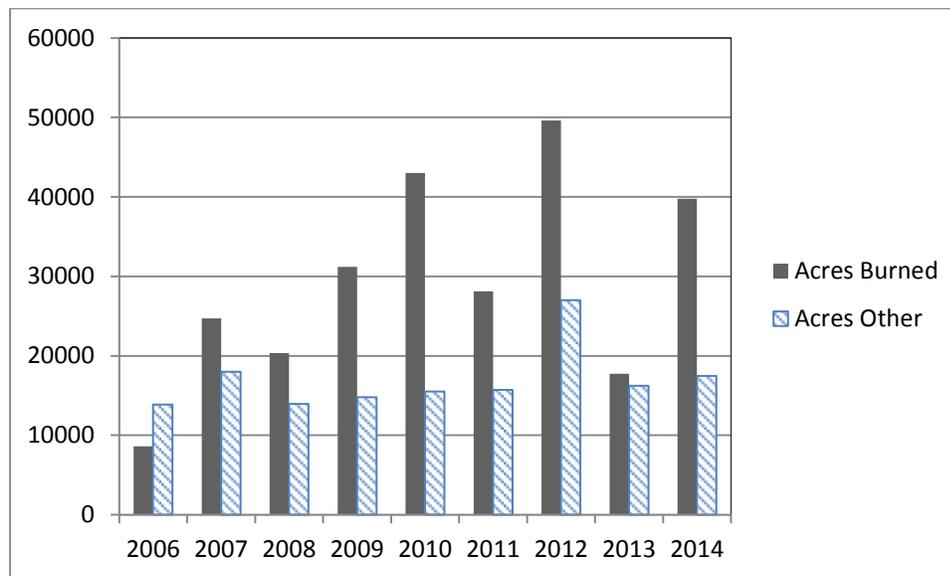


Figure 1. Acres treated annually on MTNF (other includes all tree removals) (data courtesy U.S. Forest Service- Mark Twain National Forest- March 2015).

An analysis on the amount of suitable roosting structure available on the MTNF was run through the Forest Inventory Analysis (FIA) Forest Inventory Data Online (FIDO) tool by the Forest Service on March 3, 2015 (U.S.D.A. 2015). Based on this analysis, there are over 92 million

rough culls, rotten culls, and standing snags on the Mark Twain National Forest. In all forested land in Missouri, there are approximately 1.2 billion suitable roosts available. Rough and rotten culls are likely to have the cracks and crevices northern long-eared bats tend to use, as are snags.

Swarming and staging habitat

Swarming and staging habitat is similar to summer habitat except that it is closer to the hibernacula. Bats move in and out of the caves during this period and will also roost and forage in the forest away from hibernacula or transient sites. The implementation of the U.S. Forest Service’s standards and guides outlined in their 2005 Forest Plan and 2014 amended plan will ensure an abundance of swarming and staging habitat adjacent to hibernacula. In particular, the standards of providing 20 acres of old growth and an additional 130 acres of mature forest surrounding cave entrances will provide suitable amounts of roosting and foraging habitat.

Table 7. Northern long-eared bat hibernating populations on MTNF (data courtesy U.S. Forest Service- Mark Twain National Forest- March 2015).

Cave MSS Code	Observation Date	Numbers observed
IRN001	1998	32
IRN001	2009	32
IRN001	2012	104
IRN001	2013	276
CTR010	1979	Observed
CTR010	2011	2
CTR010	2012	71
ORE007	2012	67
BRY018	2012	2
CTR003	2001	1
CHR013	2002	2
ORE100	1999	2
ORE010	1988	2
ORE019	2009	4
ORE019	2011	13
ORE019	2013	6
OZK001	2011	1
PLP150	2012	1
PUL334	1994	1
PUL257	2005	1
PUL257	2007	2
PUL257	2009	1
PUL257	2011	1
SHN222	2006	1
SGE054	2007	3
SGE054	2009	3
SGE054	2011	15
SGE054	2013	71
TNY057	2005	1
TNY057	2007	2

Cave MSS Code	Observation Date	Numbers observed
WSH015	2009	3

There is no data available indicating that there has been a reduction in the number of NLEBs that use the MTNF and the Forest Service's proactive timber management activities will continue to provide a diversity of tree species and age classes that will support an abundance of roosting habitat.

Number of potential individual NLEBs/colonies on the MTNF

The exact number of individual NLEBs and colonies on the MTNF is unknown. We have estimated that there are at least 388 colonies of NLEB on the MTNF based on the following calculations:

- There are 1.5 million acres on the MTNF
- 5% of this area does not provide habitat for NLEB: $1.5 \text{ million acres} \times 95\% = 1,425,000$ acres of forested habitat available to the species
- 2.47 acres/ha ; $1,425,000/2.47 = 576,923$ ha
- Between 1997 and 2014, the average detection rate on the MTNF for NLEB was 67% (see Table 5 above); $67\% \times 576,923 = 386,538$ ha where NLEB would be predicted to be detected
- Av. group size of NLEB = ~ 5 bats/group (Johnson et al. 2012)
- Av. colony size of NLEB = ~ 60 (U.S. Fish and Wildlife Service 2015)
- $60/5 = 12$ NLEB groups
- Average colony size in Missouri is unknown; based on literature from Owen et al. (2003), Carter and Feldhammer (2005), Broders et al. (2006), and Lacki et al. (2009), the average home range for a colony of NLEB ranges from as low as 17.7 ha to as high as 186.3. To determine an estimated colony home range of an individual group on the MTNF, we averaged the ranges in the references above and calculated it to be approximately 83ha/group
- $12 \text{ groups} \times 83\text{ha/group} = 996\text{ha} = \text{av. home range of colony}$
- $386,538 \text{ ha}/996 \text{ ha} = 388$ colonies

Number of potential individual NLEBs/colonies potentially exposed to ongoing projects involving timber removal (includes timber management and individual tree removal associated with trail maintenance, road maintenance, road reconstruction, road decommissioning, access roads for logging and mineral exploration):

- Acres subject to timber management activities: 165,924 acres
- $165,924\text{acres}/2.47 \text{ acres per ha} = 67,176$ ha
- $67,176 \text{ ha}/996 \text{ ha} = \sim 67$ colonies

- Estimated number of NLEB colonies on the MTNF exposed to timber management activities associated with 39 ongoing projects= 67 colonies from timber management
- Acres associated with non-timber management tree removal= 550 mi. long x av. of 10' wide (av. width of trail/road)= 555 x 5,280ft./mi. x10'= 29,304,000 sq. ft.=673 acres= 272 ha
- 272ha/996 ha/colony= <1colony exposed to non-timber management tree removal activities
- Total number of colonies potentially exposed to timber removal activities= 67+ <1= 67

Number of potential individual NLEBs/colonies potentially exposed to ongoing projects involving prescribed fire line construction :

- Miles of fire line= 240 mi. long x 12' wide (estimated av. width of fire line used with prescribed fire on the MTNF)= 240 mi. x 5,280ft./mi.= 1,267,000'
- Acreage of prescribed fire= 1,267,000' x 12'= 15,206,400 sq. ft.= 350 acres
- 350 acres/2.47 ha/acre= 142 ha
- 142/996= ~ <1 colony potentially exposed to prescribed fire line construction

Total number of colonies potentially exposed= 67 + <1= 67 colonies

Conservation Needs of the Species in the Action Area

The conservation needs of the species in the action area are similar to the needs rangewide. The MTNF provides habitat for swarming, hibernating, migrating, and summering NLEB, and NLEB on the MTNF have already been affected by WNS. Therefore, within the action area the conservation needs include: 1) reducing WNS-related mortality and injury; 2) maintaining suitable conditions within hibernacula and protecting them from disturbance; 3) providing suitable habitat conditions for NLEB swarming, foraging, and roosting; 4) maintaining suitable habitat conditions in identified maternity areas and reducing the removal of roost trees; 5) searching for previously unidentified areas of maternity and hibernation activity; and 6) conducting research to understand the migration patterns of NLEB that use the area during the summer or winter.

EFFECTS OF THE ACTION

This BO evaluates the effects of 39 ongoing projects on the MTNF and includes all 165,924 acres of habitat that could be impacted by timber management activities, another potential maximum of 673 acres from non-timber management tree removal projects, and another potential maximum of 350 acres from prescribed fire. The greatest potential impact to NLEB

would be from timber removal activities for the 39 ongoing projects that still must be implemented as outlined in Table 3 above. The total acreage potentially impacted from tree removal activities is $165,924 + 673 = 166,597$ acres or 67,488 ha.

Potential effects to the NLEB include direct effects and indirect effects. Direct effects occur when bats are present while the activities are being conducted; indirect effects occur later in time. Effects will vary based on the type of the proposed activity.

Our analysis of effects for northern long-eared bat entails: (1) evaluating individual NLEB exposure to action-related stressors and response to that exposure; (2) integrating those individual effects (exposure risk and subsequent response) to discern the consequences to the populations to which those individuals belong; and (3) determining the consequences of any population-level effects to the species rangewide. If, at any point, we demonstrate that the effects are unlikely, we conclude that the agency has insured that their action is not likely to jeopardize the continued existence of the species and our analysis is completed.

Direct and Indirect Effects

Effects to Hibernating Bats and Hibernacula

No effects are anticipated to wintering NLEB or their hibernacula from the proposed action because no projects will be implemented during the hibernation period that could impact hibernating bats.

Effects to Bats during Spring, Spring/Summer Habitat and Fall Migration, Fall Swarming, Staging, or to Fall Swarming Habitat

Northern long-eared bats could be exposed to tree removal activities if trees occupied by roosting bats are cut when in use. The only potential for direct take is for bats that temporarily use roost trees during spring migration, fall migration, or during staging and or swarming activities adjacent to hibernacula. While some habitat loss could occur during tree removal activities, implementation of various timber management practices will ensure an abundance of roosting habitat on the MTNF.

Effects to Spring/Summer Habitat and to Active Season Bats or to Spring/Summer Habitat

Implementation of the 39 ongoing projects could impact a total of 166,597 acres due to tree removal activities associated with timber management (165,924 acres), and those accompanying trail maintenance, road maintenance, road decommissioning (673 acres), mineral exploration (115 acres), or access roads for logging (<1 acre). Indirect effects would include the potential loss of roosting habitat but this loss is likely to be temporary as the overall objective is to maintain the health of the forest.

Death/Injury

Impacts NLEB from forest management would be expected to vary depending on the timing of removal, location (within or outside NLEB home range), and extent of removal. While bats can flee during tree removal, removal of occupied roosts (during spring through fall) is likely to result in direct injury or mortality to some percentage of bats. This is particularly likely during cool spring months (when bats enter torpor) and if flightless pups or inexperienced flying juveniles are also present. Forest management outside of NLEB summer home ranges or away from hibernacula would not be expected to result in impacts to this species. However, forest management within a summer home range (regardless of when it is removed) may, depending on the extent of removal and amount of remaining suitable roosting and foraging habitat.

Again, risk of injury or mortality is greatest in April through July when NLEB colonies are most concentrated and more bats may be found using fewer trees associated with their roosting networks. In addition, June through July is the period most likely to have non-volant pups. Removal of trees outside this period is less likely to result in injury or mortality when the majority of bats can fly and are more dispersed.

The greatest risk of take is associated with projects within known NLEB home ranges where no or few roost trees have been documented. This is because occupancy probability has already been established at 100% within that home range but it is unclear where the core roosting area is located (so cannot plan to avoid in-season clearing in those areas). Areas outside of known home ranges have some probability of occupancy from 0-100%. As discussed in the Environmental Baseline, within this forest NLEB occupancy rates are assumed to be 67% (average of 16 years of survey efforts on the MTNF and outlined in Table 5 above) and 388 maternity colonies are estimated within the forest (see calculations above). Within the action area, there is a possibility as many as 67 colonies (see calculations above).

Within a given home range NLEB use multiple roosts throughout the season. Therefore, only a certain number of roosts are anticipated to be occupied in any given day and within any given year. Therefore, the risk of encountering roosting NLEB during a given forest treatment is associated with the percentage of home range impacted and the type of forest treatment. Larger acreages of treatment have greater risk than smaller acreages. Similarly, clearcuts have greater risk than selective harvest treatments (individual or group) because more trees in a given treatment area will be removed.

Alteration of Roosting/Foraging Habitat

The best available data indicate that the NLEB shows a varied degree of sensitivity to timber harvesting practices so long as there are sufficient roosts available for their use (Menzel *et al.* 2002, Owen *et al.* 2002). In central Arkansas, the three classes of mixed pine-hardwood forest that supported the majority of the roosts were partially harvested or thinned, unharvested (50–99 years old), and group selection harvest (Perry and Thill 2007). Forest size and continuity are also factors that define the quality of habitat for roost sites for NLEB. Lacki and Schwierjohann (2001) stated that silvicultural practices could meet both male and female roosting requirements by maintaining large-diameter snags, while allowing for regeneration of forests.

In addition to impacts on roost sites, we consider effects of forest management practices on foraging and traveling behaviors of NLEB. In southeastern Missouri, the NLEB showed a preference for contiguous tracts of forest cover (rather than fragmented or wide open landscapes) for foraging or traveling and, different forest types interspersed on the landscape increased likelihood of occupancy (Yates and Muzika 2006). Similarly, in West Virginia, female NLEB spent most of their time foraging or travelling in intact forest, diameter-limit harvests (70–90 year-old stands with 30–40 percent of basal area removed in the past 10 years), and road corridors, with no use of deferment harvests (similar to clearcutting) (Owen *et al.* 2003). In Alberta, Canada NLEB avoided the center of clearcuts and foraged more in intact forest than expected (Patriquin and Barclay 2003). On Prince Edward Island, Canada, female northern long-eared bats preferred open areas less than forested areas, with foraging areas centered along forest-covered creeks (Henderson and Broders 2008). In general, northern long-eared bats prefer intact mixed-type forests with small gaps (*i.e.*, forest trails, small roads or forest covered creeks) in forest with sparse or medium vegetation for forage and travel rather than fragmented habitat or areas that have been clearcut.

Forest management is not usually expected to result in a permanent loss of suitable roosting or foraging habitat for NLEB. On the contrary, forest management is expected to maintain a forest over the long term for the species. However, localized long-term reductions in suitable roosting and/or foraging habitat can occur from various forest practices (*e.g.*, clearcuts). As stated above, NLEB have been found in forests that have been managed to varying degrees and as long as there is sufficient suitable roosting and foraging habitat within their home range and travel corridors between those areas, we would expect NLEB colonies to continue to occur in managed landscapes.

Many timber harvest regimes will result in minimal change in terms of providing suitable roosting or foraging habitat for NLEB. For example, selective harvest regimes are not anticipated to result in alterations of forest to the point where NLEB would be expected to significantly alter their normal behaviors. This is because the treatment areas will still be forested with small openings. Similarly, small patch cuts, wildlife openings, and forest roads would be expected to serve as foraging areas or travel corridors. Therefore, the only impacts of concern from these forest treatments are the potential for death or injury during active season tree removal.

Alternatively, large clearcuts (that remove a large portion of a known or assumed home range) would result in a temporary “loss” of forest for NLEB. In these cases, “temporary” would be for many years. Foraging would be possible prior to roosting depending on the juxtaposition of cuts to other forest compartments.

Some portions of the NLEB’s range are more forested than others. In areas with little forest or highly fragmented forests (*e.g.*, western U.S. edge of the range, central Midwestern states; see Figure 1), impact of forest loss would be disproportionately greater than similar sized losses in heavily forested areas (*e.g.*, Appalachians and northern forests). Also, the impact of habitat loss

within a northern long-eared bat's home range is expected to vary depending on the scope of removal. Silvis et al. (2014) modeled roost loss of northern long-eared bats and Silvis et al. (2015b) removed known northern long-eared bat roosts during the winter in the field to determine how this would impact the species. The authors determined that although the removal on multiple roosts resulted in roost network fragmentation, the species would likely respond well to direct management and natural forest disturbance processes or disturbance related to forest harvesting. Silvis et al. (2014) concluded that maternity colony fragmentation is unlikely to occur with removals of small proportions of roosts (i.e., $\leq 20\%$).

Longer flights to find alternative suitable habitat and colonial disruption may result from removal of roosting or foraging habitat. Northern long-eared bats emerge from hibernation with their lowest annual fat reserves, and return to their summer home ranges. Since northern long-eared bats have summer home range fidelity (Foster and Kurta 1999; Patriquin et al. 2010; Broders et al. 2013), loss or alteration of forest habitat may put additional stress on females when returning to summer roost or foraging areas after hibernation. Females (often pregnant) are forced to seek out new roosts or foraging areas and must expend additional, but limited, energy. Hibernation and reproduction are the most energetically demanding periods for temperate-zone bats, including the northern long-eared bat (Broders et al. 2013). Bats may reduce metabolic costs of foraging by concentrating efforts in areas of known high prey profitability, a benefit that could result from the bat's local roosting and home range knowledge and site fidelity (Broders et al. 2013). Cool spring temperatures provide an additional energetic demand, as bats need to stay sufficiently warm or enter torpor (state of mental or physical inactivity). Entering torpor comes at a cost of delayed parturition; bats born earlier in the year have a greater chance of surviving their first winter and breeding in their first year of life (Frick et al. 2009). Delayed parturition may also be costly because young of the year and adult females would have less time to prepare for hibernation (Broders et al. 2013). Female NLEB typically roost colonially, with their largest population counts occurring in the spring, presumably as one way to reduce thermal costs for individual bats (Foster and Kurta 1999). Therefore, similar to other temperate bats, NLEB have multiple high metabolic demands (particularly in spring), and must have sufficient suitable roosting and foraging habitat available in relatively close proximity to allow for successful reproduction.

In summary, prescribed fire, timber harvests and tree clearing associated with road and trail maintenance and activities could have both adverse and beneficial effects on habitat suitability for the NLEB. The approximately 166,597 acres of habitat that will be affected by these activities are scattered throughout the 1.5 million acre MTNF (see Figure 3), so there will be large amounts of unaffected, intact forested habitat adjacent to each treatment area. As a result, we conclude that the overall habitat suitability or availability within the action area should be minimally affected by timber harvest and non-timber management timber removal activities under the proposed action.

Prescribed Burning

The Forest Service may burn as many as 50,000 acres per year. Consequently, we conclude that this maximum could be associated with the 39 ongoing projects outlined above.

The USFS has proposed conducting fires during spring and fall in areas where there are NLEBs but not during the maternity season. Conducting prescribed fires outside the hibernation period could result in direct mortality or injury to NLEB by burning, heat exposure, or smoke inhalation. Bats also may be exposed to elevated concentrations of potentially harmful compounds within the smoke (e.g., carbon monoxide and irritants) (Dickinson et al. 2009). Exposure risk depends on a variety of factors including height of roosts, timing and behavior of fire, winds, proximity of fire to roosts. Risk of direct mortality and injury to bats from prescribed fire is low as long as fire intensity and crown scorch height are low (Dickinson 2010). Waiting until temperatures are a bit warmer in spring reduces more frequent use of torpor and should allow NLEB to more easily flush (Dickinson 2010). Due to the anticipated timing of the burns, [torpid adults and/or non-volant young] will not be present during the majority of the burns and most bats should be mobile during burning activities. In summary, we expect minimal lethal take from prescribed fires but NLEB may be forced to flee from roosting and foraging areas. However, these adverse effects are expected to be short-term and localized.

Indirect effects may include short-term loss of roost trees and decreases in prey abundance, followed by long-term increases in roost abundance and suitability, and in prey abundance (Boyles and Aubrey 2006, Dickinson 2010, Dickinson et al. 2009, Johnson et al. 2009, Johnson et al. 2010, Lacki et al. 2009, Timpone et al. 2009). These types of both adverse and beneficial effects have been noted for both the Indiana bat and the NLEB. While there are some differences in roosting and foraging habitat preferences between these species, there is also much overlap in habitat usage between these species, and in most cases general conclusions based on research on one species will also be applicable to the other.

Prescribed fire can create a greater abundance of potential roost trees for NLEB because fires can cause bark of live trees to peel away from the sapwood creating the sloughing bark that is often used for roosting (Johnson et al. 2010). The availability of suitable roosts (including roosts with cavities and exfoliating bark) is greater in burned areas compared to unburned areas (Boyles and Aubrey 2006, Dickinson et al. 2009, Johnson et al. 2010). NLEB have been found to use roosts extensively in burned habitats immediately after prescribed burning (Lacki et al. 2009) with roosts shifting from primarily beneath bark before burning to inside cavities after burning.

Tree species that consistently form high quality bat roosts include shellbark hickory (*Carya laciniosa*), shagbark hickory (*C. ovata*), and white oak (*Quercus alba*). Regeneration of white oak and hickory increases as a result of low-intensity fires and/or repeated fires below open canopies (Johnson et al. 2010, Dickinson et al. 2009). Similarly, fire creates canopy gaps that allow for regeneration of shade-intolerant species such as black locust, a preferred roost tree species for the NLEB in some locations (Dickinson et al. 2009, Johnson et al. 2009). Therefore, over the long-term, prescribed fire is anticipated to increase the abundance of tree species that form high quality NLEB roosts.

Fires can also create a more open canopy structure that can improve roost quality by increasing the amount of solar radiation reaching the roost. Canopy light penetration was higher and canopy tree density was lower in burned forest than in unburned forest (Boyles and Aubrey 2006). Additionally, canopy gaps in the burned area are associated with slightly higher maximum daily temperatures at roost trees (Johnson et al. 2009). Higher roost temperatures could facilitate more rapid growth of developing juvenile bats (Johnson et al. 2009). As a result, the abundance of trees with characteristics suitable for roosting, and the percentage of the forested area with suitable bat roosts, should increase after fires (Boyles and Aubrey 2006). Studies in West Virginia found that the NLEB responded favorably to prescribed fire by using new roost trees that were located in canopy gaps created as a result of the fire (Johnson et al. 2009). Conversely, fire may also destroy or accelerate the decline of existing roost trees, particularly of older snags, by burning the bases of the trees and weakening their structure, causing them to fall over quicker (Johnson et al. 2009, Dickinson et al. 2009). Lacki et al. (2009) estimated that up to 20 percent of existing standing snags were lost post-fire, and that few new snags were created.

In summary, prescribed fire may result in both adverse and beneficial effects on roosting habitat through immediate loss of existing roosts and creation of some new roosts, followed by short-term increases in the suitability of remaining and created roosts, and long-term changes in forest composition towards a greater abundance of trees likely to create suitable roosts in the future. Unfortunately, existing data are insufficient to fully quantify or compare the relative impact of these adverse and beneficial effects. For instance, the long-term tradeoff between roost creation and roost loss in mixed oak forests under burning regimes is unknown (Dickinson et al. 2009). One researcher concluded that prescribed fire, at minimum, provoked no response from Indiana bats in terms of roost tree selection, and in some cases may actually create additional roosting habitat (Johnson et al. 2010). As a result, we conclude the overall effect of the prescribed fire portion of the proposed action on roost availability may be neutral to potentially beneficial.

Prescribed fire may affect foraging habitat by changing the structure of the forest and by changing the abundance of prey within the area (Dickinson et al. 2009). NLEBs have shown a preference for foraging in heavily forested mid-slope areas, regardless of burn condition, suggesting these bats feed in and around closed canopies and are likely clutter-adapted (Lacki et al. 2009). These studies suggest that the reduction in canopy closure as a result of prescribed burning could have a negative effect on foraging suitability for the NLEB. However, that same data do not indicate that bats avoid foraging in or around areas that have been burned. For example, the size of female NLEB home ranges and core areas did not vary between bats radio tracked before and after fires, and the home ranges of these bats were located closer to burned habitats following fires than to unburned habitats (Lacki et al. 2009). The researchers for this study suggested that NLEBs respond to habitat alterations resulting from prescribed fires by shifting the location of their foraging areas to take advantage of changes in insect prey availability (Lacki et al. 2009). Immediately after fires, insect abundance typically declines (Lacki et al. 2009). Therefore, fires conducted in the late winter and early spring may reduce abundance of bat prey during critical periods when bats are coming out of hibernation, are migrating, or are pregnant (Johnson et al. 2009). However, over a longer-term (within one year),

abundance of coleopterans (beetles), dipterans (flies), and all insects combined has been shown to increase following prescribed fires (Lacki et al. 2009). These increases can last for up to 16 years post-burn. Because lepidopterans (moths and butterflies), coleopterans, and dipterans are important groups of insect prey for *Myotis* species, researchers have concluded that fire does indeed improve foraging conditions in the long-term by increasing prey quantity in the form of insects attracted to post-fire dead wood (Lacki et al. 2009, Dickinson 2010). As a result, we conclude that prescribed fire may have a short-term adverse and long-term beneficial effect on prey abundance, and thus foraging habitat suitability in the action area.

Given NLEBs frequent use of live trees and snags, multiple roosting structures, and ability to arouse and move during fires, and positive or neutral response for roosting and foraging within burned areas, NLEB are expected to experience minimal impacts from prescribed fire.

The potential for direct effects from timber management, the removal of individual trees associated with trail maintenance, road maintenance, road construction, road decommissioning or mineral exploration; and prescribed fire will be minimized by the implementation of the following conservation measures:

- The cutting or destruction of known, occupied roost trees during the pup season (June 1–July 31) will be avoided;
- Clearcuts (and similar harvest methods, *e.g.*, seed tree, shelterwood) within 0.25 (0.4 km) mile of known, occupied roost trees during the pup season (June 1–July 31) will be avoided;
- Hazard trees will only be removed between November 1 and April 1 whenever possible;
- Designate an area of at least 20 acres completely surrounding a threatened, endangered, candidate, proposed, or rare species of 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;
- Maintain an additional 130 acres of mature forest or mature woodland around each occupied threatened, endangered, candidate, proposed, or rare species of bat cave;
- The area around occupied threatened, endangered, candidate, proposed, or rare species of 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;
- 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;
- Prohibit removal of suitable roost trees and prescribed burning within the 20 acres of old growth and 130 acres of forest or mature woodland surrounding a threatened,

endangered, candidate, proposed, or rare species of bat hibernacula during the swarming and staging periods. Determine dates individually for each cave (normally between September 1 and November 1 and between March 15 and April 30 respectively);

- 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;
- Remove hazard trees between November 1 and April 1 whenever possible;
- 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;
- All even-aged regeneration harvests shall retain at least 7%-10% of the harvest unit in reserve trees and/or reserve tree groups;
- Reserve trees and reserve tree groups should include a combination of the following: the largest, long-lived species occurring on the site (short leaf pine, white oak, post oak, hickory, black gum); standing dead trees; and cavity or den trees.

Impacts from prescribed fire however would be limited to burns that occur during the species' spring and fall migration, swarming or staging periods as none are proposed during the summer maternity season and all bat hibernacula are designated as smoke-sensitive areas. Such areas require burn plans that outline actions that would avoid or minimize smoke influences at or near these caves.

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 pursuant to section 7 of the ESA. Any actions conducted on the MTNF lands will either be conducted by the USFS, or will require approval by the USFS and thus will require separate section 7 consultation. Therefore, cumulative effects, as defined in the ESA, are not expected to occur on MTNF lands.

Summary of Effects

Impacts to Individuals

Potential effects of the action include direct effects to NLEB present within the action area when activities are being conducted, and indirect effects as a result of changes in habitat suitability. Direct effects include mortality, injury, harm, or harassment as a result of removal or burning of roost trees.

The conservation measures outlined above will reduce the potential for direct effects to the NLEB. Overall, the potential for direct mortality of NLEB from prescribed burns associated with the proposed action is low. However, the potential for direct effects from timber harvests, road-related activities and prescribed fire is greatest during spring and early summer when bats return from hibernation, spring temperatures result in periodic use of torpor, and non-volant young may be present (mid-April to July). In addition, bats impacted by WNS have additional energetic demands and reduction in flight ability.

Indirect effects from the action may result from habitat modification and primarily involve changes to roosting and foraging suitability. Timber harvests and tree clearing associated with road-related activities could have both adverse and beneficial effects on habitat suitability for the NLEB. Prescribed fire may also result in both adverse and beneficial effects on roosting habitat through loss and creation of existing roosts, and long-term changes in forest composition towards a greater abundance of suitable roosts in the future. Prescribed fire may also have a short-term adverse and long-term beneficial effect on prey abundance, and thus foraging habitat suitability in the action area. The overall effect of the prescribed fire portion of the proposed action on habitat suitability may be neutral to potentially beneficial. Given the scope of the projects in relation to the overall action area, these projects will not substantially alter the overall availability or suitability of NLEB roosting or foraging habitat.

While none of the USFS's proposed actions will alter the amount or extent of mortality or harm to NLEB resulting directly from WNS, the USFS's proposed action can be neutral, negative, or beneficial to bats. We anticipate that there will be some impact to the roosting habitat of NLEBs during spring and fall migration/staging, and during the fall swarming period if bats use trees for roosting. The continued implementation of the USFS's monitoring effort will provide additional information on the effect of the USFS's actions on affected bats. No cumulative effects are anticipated.

While analyzing the effects of the proposed action, we identified the life stages that would be exposed to the stressors associated with the proposed action, and analyzed how those individuals would respond upon exposure to the stressors. From this analysis, we determined that:

- 1) There is no proposed critical habitat for the NLEB, and thus, none will be adversely affected.
- 2) Some bats moving between staging or swarming areas and adjacent hibernacula, or during spring and fall migration could be impacted from timber removal activities or prescribed fire identified in Table 4. There are no known NLEB maternity roosts known within the boundaries of the 39 ongoing projects identified above.
- 3) NLEB during the spring-fall period will be exposed to various project stressors and are likely to adversely respond to some of them. As stated in the environmental baseline, we believe that there may be as many as 67 NLEB colonies impacted by the 39 ongoing projects being implemented. However, given the implementation of conservation

measures previously discussed, we anticipate that only a small portion of estimated colonies are likely to be impacted by these actions.

We considered the possibility for exposure to NLEB at currently unknown roost sites in the vicinity of forest management activities. If this should occur, we anticipate minor effects and possibly harassment of some NLEB that may flush during daylight and temporarily or permanently abandon their roosts.

Impacts to Populations

As we have concluded that there may be minor impacts to individual NLEBs, we need to assess the aggregated consequences of the anticipated reductions in fitness (i.e., reproductive success and survival), of the exposed individuals on the population(s) to which these individuals belong.

The USFS's previous and ongoing efforts have served to identify areas of NLEB maternity activity, and after completion of the action, the area will continue to provide suitable habitat conditions for NLEB foraging and roosting during the summer and fall swarming period. While there is potential for direct take of the species, given the small-scale of the proposed action in relation to the action area, and the current distribution and abundance of the NLEB on the MTNF (as described in the Environmental Baseline), we anticipate that the NLEB will continue to survive and reproduce in areas impacted by the 39 ongoing actions.

We do not anticipate population level effects resulting from impacts from these ongoing actions. Given that only a few individuals are likely to be impacted due to the implementation of multiple conservation measures, populations to which they belong are likely to be able to successfully reproduce such that there is no impact to the overall survival and recovery of the species within the action area.

CONCLUSION

Impacts to the Species

Reductions in maternity colonies' and associated wintering population fitness are unlikely to occur. In fact, we find that many of the proposed actions of the USFS are likely to result in benefits to the species over the long term due to the maintenance of a mosaic of forest types. Thus, no component of the proposed action is expected to reduce the reproduction, numbers, or distribution of the NLEB rangewide. While we recognize that the status of the species is uncertain due to WNS, given the environmental baseline, and the intensity, frequency, and duration of the project impacts and we found that the proposed project is unlikely to have population-level impacts, and thus, is also unlikely to decrease the reproduction, numbers, or distribution of the NLEB. Therefore, we do not anticipate a reduction in the likelihood of both survival and recovery of the species as a whole.

Based on the analysis above, despite the anticipated population impacts, given the analysis in the interim 4(d) rule, the proposed action should not decrease the reproduction, numbers, or distribution of the NLEB. Therefore, we do not anticipate an appreciable reduction in the likelihood of both survival and recovery of the species as a whole.

After reviewing the current status of this species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the northern long-eared bat.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or 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 (50 CFR § 17.3). Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR § 17.3). 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 ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

On April 2, 2015, the Service published an interim species-specific rule pursuant to section 4(d) of the ESA for northern long-eared bat (**80FR 17974**; U.S. Fish and Wildlife Service 2015). The Service's interim 4(d) rule for northern long-eared bat exempts the take of northern long-eared bat from the section 9 prohibitions of the ESA, when such take occurs as follows (see the interim rule for more information):

- (1) Take that is incidental to forestry management activities, maintenance/limited expansion of existing rights-of way, prairie management, projects resulting in minimal (<1 acre) tree removal, provided these activities:
 - a. Occur more than 0.25 mile (0.4 km) from a known, occupied hibernacula;
 - b. Avoid cutting or destroying known, occupied roost trees during the pup season (June 1–July 31); and
 - c. Avoid clearcuts (and similar harvest methods, *e.g.*, seed tree, shelterwood, and coppice) within 0.25 (0.4 km) mile of known, occupied roost trees during the pup season (June 1–July 31).
- (2) Removal of hazard trees (no limitations).
- (3) Purposeful take that results from

- a. Removal of Bats From and Disturbance Within Human Structures and
- b. Capture, handling, and related activities for northern long-eared bats for 1 Year following publication of the interim rule.

The incidental take that is carried out in compliance with the interim 4(d) rule does not require exemption in this Incidental Take Statement. Accordingly, there are no reasonable and prudent measures or terms and conditions that are necessary and appropriate for these actions because all incidental take has already been exempted. The activities that are covered by the interim 4(d) are as follows : timber management, prescribed fire, hazard tree removal and the removal of individual trees for road construction or decommissioning. The remainder of this analysis addresses the incidental take resulting from those elements of the proposed action that are not covered by the 4(d) rule.

AMOUNT OR EXTENT OF TAKE

If NLEB are present or utilize an area proposed for timber harvest, prescribed fire, or other disturbance, incidental take of NLEB could occur. The Service anticipates incidental take of the NLEB will be difficult to detect for the following reasons: (1) the individuals are small and occupy summer habitats where they are difficult to find; (2) NLEB form small, widely dispersed maternity colonies under loose bark or in the cavities of trees, and 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 in the action area is unknown; and (5) in many cases incidental take will be non-lethal and undetectable.

Monitoring to determine actual take of individual bats within an expansive area of forested habitat is a complex and arduous task. Unless every individual tree that contains suitable roosting habitat is inspected by a knowledgeable biologist before management activities begin, it would be impossible to know if a roosting NLEB is present in an area proposed for harvest or prescribed burn. Inspecting individual trees is not considered by the Service to be a practical survey method and is not recommended as a means to determine incidental take. However, the areal extent of potential roosting and foraging habitat affected can be used as a surrogate to monitor the level of take.

The Service acknowledges that both exempted and non-exempted incidental take will occur due to the exposure of NLEB to management activities associated with the 39 ongoing projects. Potential effects of the action include direct effects to NLEB present within the action area when activities are being conducted, and indirect effects as a result of changes in habitat suitability. Direct effects include mortality, injury, harm, or harassment as a result of removal or burning of roost trees or potential impacts to roosting bats during tree removal activities. Currently, there are no known, occupied maternity colonies of NLEB within the 338 acres of the 39 ongoing projects where management actions are planned. Due to capture rates of NLEB on the MTNF, however, there could be unknown maternity roosts within this area and, if so, the potential of

lethal take if a roost is occupied by non-volant young. However, only 1/3 of timber removal activities will occur during this period (fide Theresa Davidson, U.S. Forest Service, pers. comm. April 29, 2015) so the potential of direct lethal take is anticipated to be minimal. Additionally, none of the planned prescribed burning or construction of prescribed fire lines would occur during this period (fide Theresa Davidson, pers. comm. April 29, 2015). The implementation of the conservation measures outlined above will further reduce the potential for mortality or other adverse effects. The greatest potential for take will be during staging and swarming activities adjacent to occupied hibernacula. Even then, it is anticipated that the majority of take will be in the form of harm or harassment of roosting bats that will likely fly to a new location.

Indirect effects from the action may result from habitat modification and primarily involve changes to roosting and foraging suitability. We anticipate that there will be some impact to the roosting habitat of NLEBs during spring and fall migration/staging, and during the fall swarming period if bats use trees for roosting. Due to implementation of the conservation measures outlined above and the beneficial forest management actions, overall roosting and foraging habitat is predicted to be maintained and enhanced.

The Service anticipates that no more than 166,947 acres of potential NLEB habitat will be disturbed as a result of these ongoing project activities on the MTNF, including 165,924 acres from timber harvest, 350 acres from prescribed fire, 673 acres from road decommissioning or construction, 115 acres associated with tree removal involving mineral exploration and < 1 acre for access roads for logging. This includes 166,609 acres of exempted take and 338 acres of non-exempted take (Table 8). The number of maternity colonies potentially impacted by the management actions associated with these 39 projects is unknown but anticipated to minimal due to the Forest Service’s commitment to the implementation of conservation measures outlined above.

Table 8. Incidental take of NLEB for 39 ongoing actions on the MTNF.

Type of take	Total Acres
Exempted	166,609
Non-exempted	338

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to northern long-eared bat. No critical habitat has been designated for northern long-eared bat, so none would be impacted.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to further minimize take of northern long-eared bat. This applies to the 338 acres

within 0.25 mi. buffer area around occupied hibernacula that are not exempted by the interim 4(d) rule. The Service believes that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the incidental take of Indiana bats and northern long-eared bats:

1. Avoid direct mortality of NLEB in known occupied roosts.
2. Locate, maintain, and monitor known occupied roost trees.
3. Ensure the presence of an adequate short-term supply of roost trees and maintain a continuous, long-term supply of high quality roost trees.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the Act, the following terms and conditions, which implement the reasonable and prudent measure described above applies. These terms and conditions are non-discretionary:

1. Avoid direct mortality of NLEB in known occupied roosts
 - a. All known NLEB occupied roost trees will be retained until they naturally fall to the ground
2. Locate, maintain, and monitor known occupied roost trees and NLEB hibernacula
 - a. To the extent practical, presence and use of the project area by NLEBs will be determined through surveys (capture and radio telemetry) and location of roost trees in the project area will be determined, if applicable
 - b. Survey and monitoring results shall be submitted following the summer survey season to the Columbia Missouri Ecological Services Field Office of the Service
Reports must contain:
 - i. Description of management or habitat manipulations occurring in the area
 - ii. The results of the mist netting survey, including number, sex, age (mature or juvenile) and reproductive status of all bats captured if any are documented
 - iii. Whether or not dead NLEBs were found in the project area. Should one or more NLEBs be encountered during the course of the project, the Columbia Missouri Field Office must be notified upon the discovery, and the number, age, sex, and reproductive status of the bat(s) is to be reported
 - c. If any NLEBs are found dead or injured following the necessary removal of a tree during the migration, staging, or fall swarming, the following protocols are requested:
 - i. Contact Shauna Marquardt of our office at shauna_marquardt@fws.gov (573-234-2132, ext. 174) for deposition of specimens. She will contact appropriate individuals regarding final deposition and use of any specimen pending condition of the recovered carcass
 - ii. Specimens should be frozen in a plastic bag and include date and location with latitude and longitude coordinates
 - iii. Contact USFWS law enforcement in St. Peters Missouri: 636-441-1909

- iv. Provide a report on the circumstances surrounding the discovery and incidental taking
3. Provide an adequate short-term supply of high quality roost trees and maintain a continuous, long-term supply of high quality roost trees
 - a. Current baseline habitat conditions will be enhanced in order to provide adequate short-term roosting opportunities. This will be accomplished through the natural generation of snags as well as retention of snags and potential roost trees following Forest Service guidelines.

REPORTING REQUIREMENTS

1. The USFS shall provide report summarizing the activities (and acreages) described in this ITS upon completion of the project(s).
2. The USFS shall make all reasonable efforts to educate personnel to report any sick, injured, and/or dead bats (regardless of species) located on the MTNF immediately to Theresa Davidson (573-341-7499; tmdavidson@fs.fed.us). The USFS point of contact will subsequently report to the Service's Columbia, Missouri Ecological Services Field Office (CMFO) to the attention of Shauna Marquardt (573-234-2132; ext. 174; shauna_marquardt@fws.gov).. No one, with the exception of trained staff or researchers contracted to conduct bat monitoring activities, should attempt to handle any live bat, regardless of its condition. If needed, CMFO will assist in species determination for any dead or moribund bats. Any dead bats believed to be NLEB will be transported on ice to the CMFO. If an NLEB is identified, CMFO will contact the appropriate Service law enforcement office. Care must be taken in handling dead specimens to preserve biological material in the best possible state. In conjunction with the care of sick and injured fish or wildlife and the preservation of biological materials from dead specimens, the USFS has the responsibility to ensure that information relative to the date, time, and location of NLEB, when found, and possible cause of injury or death of each is recorded and provided to the Service. In the extremely rare event that someone has been bitten by a bat, please keep the bat in a container and contact the local health department.

CONSERVATION RECOMMENDATIONS

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

The Service has identified the following actions that would further the conservation of the NLEB. We recognize that limited resources and other agency priorities may affect the ability of the Forest Service to conduct these activities at any given time. Nonetheless, under Sections 2(c)(1) and 7(a)(1) of the Endangered Species Act, the Forest Service has responsibilities to

contribute to the recovery of federally listed species for lands they manage and thus should undertake conservation measures to the maximum extent practicable.

1. Conduct surveys for bats on the MTNF to better define areas of occupancy relative to each Forest Service District
2. Assist with WNS investigations. For example:
 - a. Monitor the status/health of known colonies
 - b. Collect samples for ongoing or future studies
 - c. Allow Forest Service staff to contribute to collaborative research projects
3. Monitor post-WNS distribution of WNS-affected species in Missouri
 - a. Conduct targeted Presence/Probable absence surveys
 - b. Conduct radio telemetry to monitor status of colonies
4. Encourage collaborative research on the summer habitat requirements of NLEB on the MTNF that contribute to knowledge of:
 - a. Habitat characteristics of the forest in areas where post-WNS population occurrences have been documented, and
 - b. Bat use (acoustics, radio telemetry) of recently managed areas where various prescriptions have been implemented.

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 conservation recommendations carried out.

REINITIATION NOTICE

This concludes formal consultation for the USFS's actions outlined in your request dated March 13, 2015. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over an action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such a take must cease pending reinitiation.

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Appendix A- Consultation History

- June 14, 2005: Forest Service submitted a programmatic BA for the revised MTNF LRMP and requested formal consultation when they determined a “may affect, likely to adversely affect” determination for Indiana bat and Mead’s Milkweed.
- September 16, 2005: FWS issued a no jeopardy programmatic BO for Indiana bat and Mead’s milkweed.
- September 17, 2014: Forest Service submitted a BA for an amendment on the FS’ LRMP and initiated informal consultation with the FWS for actions that may affect the Ozark Hellbender, snuffbox, spectaclecase, and sheepnose mussels as well as critical habitat for the Hine’s Emerald Dragonfly and Tumbling Creek cavesnail.
- November 19, 2014: FWS issued a concurrence of a may affect, not likely to adversely affect for the Hine’s Emerald Dragonfly and Tumbling Creek Cavesnail.
- March 16, 2015: Forest Service submitted a programmatic BA for ongoing actions that they previously consulted involving the potential impact of various timber management activities on Indiana bat. The FWS’ enclosed draft BO is a batched BO to cover all projects previously consulted on involving Indiana bat that are likely to adversely affect NLEB.

Appendix B- Completion dates for consultation with the FWS involving Indiana bats or other federally listed species with a “may affect, likely to adversely affect” determination associated with the FWS’ Sep. 16, 2055 BO.

Ava/Cassville/Willow Springs Ranger District

- Brushy Creek and Clayton Ridge Project (no effect for Indiana bat because only cedar removal)
- Blue Hole Project – 8/21/08
- Turnip Knob Project – 12/31/07
- Garrison Ridge Project – 8/10/06
- Greasy Creek Project – 6/20/12
- Indian Creek Project – 6/20/12
- Ava Glades East Project – 7/11/12
- North Fork Boat Access – 2/23/15

Eleven Point Ranger District

- Handy Natural Community Restoration Project – 1/7/09
- Possum Trot Project – 2/2/05

- Van Buren Project – 4/6/11 & amended 6/29/12
- Westside Project – 2/1/07
- Fremont Project – 9/19/14

Poplar Bluff Ranger District

- Cane Ridge East Project – 10/4/07
- Cane Ridge West Project – 9/10/09
- Carson Hill Salvage Project – 7/25/12
- Kelly Valley Salvage Project – 7/25/12
- Cattail Creek Salvage Project – 7/25/12

Houston/Rolla/Cedar Ranger District

- Crescent II Project – 12/27/04
- Fairview Project – 3/5/07
- Kaintuck West Project – 6/29/11
- Lynchburg Project – 12/12/07
- Southard Project – 7/6/06
- Teasley Hollow Project – 9/21/12
- Boiling Springs – 2/10/14

Salem Ranger District

- Medley Hollow Project – 10/25/07

Potosi Ranger District

- Shirley Project – 1/6/11
- Shoal Creek Project – 6/7/07
- East Fredericktown Project – 5/26/06