

Programmatic Biological Opinion and Conference Opinion For Imperiled Bats on the Ouachita National Forest

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EXECUTIVE SUMMARY

This Endangered Species Act (ESA) Biological Opinion (BO) of the U.S. Fish and Wildlife Service (Service) addresses the Ouachita National Forest's (Forest) proposed implementation of the Revised Land and Resource Management Plan (Forest Plan; implementation of the Forest Plan will herein be referred to as "the Action"). The Forest proposes to conduct routine activities implemented by or authorized by the Forest to achieve the goals and objectives of the Forest Plan. The Forest determined that the Action is likely to adversely affect Indiana bat (*Myotis sodalis*; IBAT), northern long-eared bat (*Myotis septentrionalis*; NLEB), and tricolored bat (*Perimyotis subflavus*; TRBA) (herein referred to as "covered species") and requested formal consultation with the Service. The BO concludes that the Action is not likely to jeopardize the continued existence of these species. This conclusion fulfills the requirements applicable to the Action for completing consultation under §7(a)(2) of the ESA of 1973, as amended, with respect to these species and designated critical habitats.

The Forest also requested concurrence on the determination that the Action is not likely to adversely affect little brown bat (*Myotis lucifugus*; LBBA), Eastern black rail (*Laterallus jamaicensis ssp. jamaicensis*), piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), Missouri bladderpod (*Physaria filiformis*), alligator snapping turtle (*Macrochelys temminckii*), Ouachita fanshell (*Cyprogenia sp. cf. aberti*), pink mucket (*Lampsilis abrupta*), and rabbitsfoot (*Quadrula cylindrica cylindrica*). The Service concurs with this determination for these species.

Reinitiating consultation is required if the Forest retains discretionary involvement or control over the Action (or is authorized by law) when:

- (a) the amount or extent of incidental take is exceeded,
- (b) new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO,
- (c) the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO, or
- (d) a new species is listed or critical habitat designated that the Action may affect.

CONSULTATION HISTORY

This section lists key events and correspondence during this consultation. A complete administrative record of this consultation is on file in the Service's Arkansas Ecological Service Field Office (AFO).

2005-08-09 – Formal consultation on the Biological Assessment (BA) for the Forest Plan was requested by the Acting Regional Forester via letter to the AFO.

2005-08-17 – The AFO submitted a transmittal letter accepting the request for formal consultation. The transmittal letter also concurred with the "not likely to adversely affect" determination for IBAT and all other species occurring within the action area.

- 2005-09-22** – A BO for the American Burying Beetle was signed and sent to the Forest.
- 2015-01-12** – The Forest transmitted the “Biological Assessment for Activities Affecting NLEBs on Southern Region National Forests,” signed December 22, 2014, to the Service. This document assessed Forest Plan activities occurring after April 1, 2015, for the Forest Plan duration, including activities that occur during winter hibernation. This document developed programmatic level potential effects from forest management activities to support determinations for the species by compiling annual acreages corresponding to Forest Plan objectives for each activity type that may affect the NLEB.
- 2016-02-11** – The Service implemented the NLEB final 4(d) rule. The Forest Service Regional Forester sent a letter to the Service’s Region 4 Director providing their decision to implement the NLEB final 4(d) rule using the voluntary process outlined in the January 5, 2016, NLEB Programmatic BO.
- 2021-04-08** – The first documented record of an IBAT (Bat 300) in McCurtain County occurred within the proposed project area on the Tiak Unit. The Oklahoma Ranger District began immediate informal consultation and monitoring efforts with the AFO and Oklahoma Ecological Service Field Offices (OFO).
- 2022-01-06** – The Forest submitted a BA to the OFO for the Tiak Vegetation Management Project C1813-1817 and a request seeking to initiate formal consultation based on the new discovery of IBAT.
- 2022-06-28** – The OFO sent, via email, a signed BO, dated June 27, 2022, to the Forest concluding formal consultation for the IBAT on the Tiak Unit in Oklahoma.
- 2022-11-17** – Forest and Ozark-St. Francis National Forest met with AFO and agreed on the need to reinstate consultation to cover NLEB, IBAT, TRBA, and LBBA.
- 2022-12-06** – Forest submitted via email the first draft of the biological assessment for AFO review and comment.
- 2023-01-29** – AFO provided comments via email for the first draft of the Forest’s BA.
- 2023-04-14** – Forest submitted via email a draft BA and the transmittal letter to initiate formal consultation on NLEB, IBAT, and TRBA with the AFO. The LBBA was consulted on informally.
- 2023-05-18** – Forest submitted via email the final BA with a few revisions to the conservation measures.
- 2023-05-22** – AFO submitted via email the final PBO/CO for Imperiled Bats on the ONF and transmittal letter which concluded consultation.

2024-11-26 – Forest submitted via email the re-initiation request (letter dated 11/22/24) and revised final BA to the Service. This was done to account for additional acres of tree removal and amending the Forest Site Clearing activity type for the Mena Trails project.

BIOLOGICAL OPINION

1. INTRODUCTION

A biological opinion (BO) is the document that states the findings of the U.S. Fish and Wildlife Service (Service) required under section 7 of the ESA of 1973, as amended, as to whether a Federal action is likely to:

- jeopardize the continued existence of species listed as endangered or threatened; or
- result in the destruction or adverse modification of designated critical habitat.

The Federal action addressed in this BO is the Forest's proposed implementation of the Forest Plan. The Forest requested to reinitiate consultation on the Forest Plan for IBAT, initiate consultation on NLEB, and conference on TRBA and LBBA. This consultation request is in response to the recent range expansion and newly collected data on IBAT, reclassification of NLEB to endangered, proposal to list TRBA as endangered, and the current Discretionary Status Review and potential future listing of the LBBA. Although the Forest consulted on IBAT in 2005, the range expansion of the species, newly collected data, along with the narrowly focused affects analysis in the 2005 BA, has resulted in the Forest requesting to reinitiate consultation on this species.

The Forest's BA addresses the expected effects to the above listed species from implementation of routine activities implemented by or authorized by the Forest to achieve the goals and objectives of the Forest Plan, including newly proposed recreation on the Mena Ranger District. The Forest determined that the Action is not likely to adversely affect LBBA, along with eight other species (listed above in executive summary) and requested Service concurrence. The Service concurs with this determination for these species. This concurrence fulfills the Forest's responsibilities for the Action under §7(a)(2) of the ESA for this species. Therefore, this BO considers the effects of the Action on IBAT, NLEB, and TRBA. The Action does not affect designated critical habitat; therefore, this BO does not address critical habitat. Additionally, a concurrence letter dated August 17, 2005, documented "no effect" and NLAA determinations for 11 other listed species (as shown in the Forest BA signed August 2, 2005) that may occur on the Forest.

BO Analytical Framework

A BO that concludes a proposed Federal action is *not* likely to *jeopardize the continued existence* of listed species and is *not* likely to result in the *destruction or adverse modification* of critical habitat fulfills the Federal agency's responsibilities under §7(a)(2) of the ESA.

"Jeopardize the continued existence means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR §402.02).

"Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR §402.02).

The Service determines in a BO whether we expect an action to satisfy these definitions using the best available relevant data in the following analytical framework (see 50 CFR §402.02 for the regulatory definitions of *action*, *action area*, *environmental baseline*, *effects of the action*, and *cumulative effects*).

- a. *Proposed Action*. Review the proposed Federal action and describe the environmental changes its implementation would cause, which defines the action area.
- b. *Status*. Review and describe the current range-wide status of the species or critical habitat.
- c. *Environmental Baseline*. Describe the condition of the species or critical habitat in the action area, without the consequences to the listed species caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early consultation, and the impacts of State or private actions which are contemporaneous with the consultation.
- d. *Effects of the Action*. Predict all consequences to species or critical habitat caused by the proposed action, including the consequences of other activities caused by the proposed action, which are reasonably certain to occur. Activities caused by the proposed action would not occur but for the proposed action. Effects of the action may occur later in time and may include consequences that occur outside the action area.
- e. *Cumulative Effects*. Predict all consequences to listed species or critical habitat caused by future non-Federal activities that are reasonably certain to occur within the action area.
- f. *Conclusion*. Add the effects of the action and cumulative effects to the environmental baseline, and considering the status of the species, formulate the Service's opinion as to whether the action is likely to jeopardize species or adversely modify critical habitat.

2. PROPOSED ACTION

The Action includes all routine activities involved in the continued implementation of the Forest Plan. These activities include timber harvest (including thinning, clearcuts, seed trees and shelterwoods), mulching, reforestation site preparation, wildlife stand improvement, glade restoration, prescribed burning, fireline construction and maintenance, road construction, erosion control, culvert and bridge replacement and maintenance, wildlife opening creation and maintenance, pond construction and maintenance, stream restoration and bank stabilization, oil gas, and mineral leases, recreation site development and maintenance, trail construction and maintenance, non-native invasive species control, right-of-way maintenance, range allotment management, and mine/cave gating, as needed. Furthermore, the Forest proposes implementation of bat specific conservation measures (listed below) to avoid and/or minimize effects to bats, as well as to support their protection and recovery. Projects covered by this BO will implement these conservation measures. If a proposed project is inconsistent with these measures, then the Forest will seek separate consultation coverage for these species.

2.1. Commercial Timber Harvest

Commercial timber harvests, including regeneration harvest, thinning, salvage, and sanitation cuts, are important management activities on the Forest that have the potential to affect these bat

species and their habitat. Timber harvest is conducted to achieve various objectives, which include improving the structure and composition of the forested stands, regeneration to promote stand age diversity, which is important for forest health and wildlife habitat, and commodity production in support of local economies. The projected harvests for the Forest under Objectives 06 – 10 (Appendix A) of the Forest Plan are geared toward creation of forest subsystems for grass/forb, woodlands, early seral conditions, treating offsite loblolly and to reduce susceptibility to beetle outbreaks.

Regeneration timber harvest treatments, which include shelterwood and seedtree harvests, are treatments of mature stands that involve removal of most trees and leaving a residual basal area of 10 – 40 square feet per acre. After the stand has advanced regeneration of young trees established, there is an option to remove or retain the residual overstory trees. Clearcuts are similar, except they have a target residual basal area of 0 – 10 square feet per acre. Single tree and group selection are treatments that result in regeneration of stands that favor shade-tolerant species or if there is a need for a stand of multiple age classes. Commercial thinning involves intermediate thinning, typically resulting in a residual basal area of 50 – 80 square feet per acre or restoration thinning, resulting in a residual basal area of 40 – 60 square feet per acre for woodland restoration or 0 – 40 square feet per acre for savannah or glade.

Once the timber sale contract is awarded, the contractor has a specified timeframe, typically 3 – 5 years, to complete all specified items within the contract. Timber harvest operations include clearing land for the construction of log landings and temporary roads, felling of trees according to the silvicultural prescription, yarding trees to the landings via skid trails, and erosion control and site restoration on skid trails, landings, and temporary roads. Temporary roads are left in a stable condition when operations are not active and are closed and seeded after use.

Salvage and sanitation harvests are conducted in the same way as a typical timber harvest; however, the objective is to salvage trees for use as wood products following natural disasters such as windstorms, tornados, heavy snow/ice, and floods or to control insect or disease outbreaks (e.g., gypsy moth, southern pine beetle). Although salvage sales are like other timber sales, they are typically implemented quickly to recover dead or damaged trees for forest products before they decay or become unsuitable for commercial use and/or to reduce spread of insects and disease. Potential salvage depends on the amount and severity of future tree mortality and damage resulting from events such as insect outbreaks, ice storms, and windstorms.

Designated firewood collection areas on the Forest allow the public to remove standing or downed wood. Firewood permit areas typically occur where trees have been designated by a district office or that were felled during non-commercial activities, such as those mentioned above. Most firewood collection occurs during the fall and winter months but can occur year-round. Removal involves chainsawing individual trees that are marked or occur in a permitted area. There is the possibility of firewood collection occurring during the active season. The Forest may sell trees within 200 feet of the right of way under a special permit. In some cases, standing dead trees are marked as hazard trees and will be made available for firewood collection. Snags, by definition, are never targeted and would only be cut if they present a public

hazard. Snags outside the 200-foot buffer or those not marked, would be left. These trees would only be available during the period when bats are hibernating.

Maximum annual activities for consultation:

- Thinning, salvage, firewood, and sanitation (47,000 acres)
- Regeneration (15,000 acres)

2.2. Non-commercial Silvicultural Activities

Non-commercial silvicultural activities are conducted to improve forest health, structure, or composition, and are most frequently conducted in young age stands or to treat sub-canopy layers in more mature stands. Although this type of treatment often targets smaller diameter trees, large diameter tree felling can occur with bats roosting in or near these treatments.

Precommercial thinning, timber stand improvement, or tree release is the removal of trees to create desired stocking levels and to shape the species composition of the stand created by removing trees manually, mechanically, or chemically that are too small to be considered commercially viable. Understory removal targets 1 inch diameter or smaller stems and is typically conducted to achieve target stocking density and species composition. Midstory removal targets 1 – 10-inch diameter stems and has the goal of promoting desirable seedling recruitment or promoting grasses, forbs, or cane stalks for wildlife habitat benefit.

Precommercial thinning also involves mechanical or chemical treatments to remove competing trees that are generally 5 inches in pine and 6 inches in hardwood or less in diameter. These smaller trees may be sold as firewood or even pulp. Finally, eastern red cedar removal will be conducted to restore stand composition and may target all stem sizes. The trees are typically felled, sometimes limbs will be bucked, or in other cases will be masticated with a machine mulching head.

Site preparation involves the mechanical use of heavy equipment to clear the planting site of unwanted vegetation or planting obstructions. This may be as simple as plowing and discing an area of dense sod, or as major as completely clearing a site of undesirable trees (such as honey locust, sweet gum, Chinese privet and maples).

Typically, non-commercial activities do not require skid trails, log landings and temporary road construction. Biomass material is typically left in the stand to decompose or in other cases, consumed by prescribed fire. Projects that introduce large wood structures for aquatic and riparian restoration will occur across the forest. Up to 1000 acres/year will be treated in aggregate. Treatment sites will generally be less than ½ acre in size, will be discontinuous, and divided among multiple stream reaches across the forest. Stream restoration projects utilizing large wood will favor utilization of non-native and off-site tree species where available, brush and immature vegetation, and healthy, structurally simplistic, native trees up to 30" diameter at breast height (DBH). The project will favor for retention trees larger than 30" DBH, structurally complex trees or bark, snags, cavity trees, or those with obvious signs of wildlife utilization.

Maximum annual activities for consultation:

- Tree release, wildlife or timber stand improvement, mulching, precommercial thinning (21,000 acres)

2.3. Prescribed Burning

Prescribed fire is a tool that, when used along with stem density removal, provides ecosystem restoration across much of the Forest. Fire has played a historical role in the ecosystem of the forest by providing a disturbance element that creates heterogeneity in the midstory and understory vegetation, promotes fire-tolerant species, and creates gaps in the canopy. The prescribed fire program on the Forest is intended to closely match the historic fire frequency and intensity for management of species that are adapted to fire-related ecological disturbances. Prescribed fire also reduces hazardous fuel accumulations for the safety of people and communities. According to Objectives 01 and 02 of the Forest Plan (Appendix A), prescribed burning across the Forest should treat an average of 180,000 acres annually but allows up to 250,000 acres. The Forest is requesting maximum acres allotted by the Forest Plan.

Successful prescribed fire implementation requires fireline construction and other types of preparation. Firelines generally consist of existing roads, trails, and streams wherever possible. In areas where control lines need to be constructed, methods include use of hand tools and/or bulldozer. Lines typically consist of 2 – 10-foot-wide strips dug to mineral soil. Some smaller trees (9" DBH or less) are felled during construction, but larger trees are avoided with the line going around and between them. Snags (standing dead trees) near the line, which pose a hazard to personnel, or which may burn and fall across the line and ignite fire outside the containment line, are felled by either bulldozer or chainsaw. Each year, existing firelines (old burns) pushed to remove leaf litter and debris are done after November 1; however, "green lines" (initial paths that are pushed with a small dozer) are sometimes built in June and July. No snags or trees with >4 inch average DBH will be pushed in this initial phase along the fireline. Typically, each line is walked by specialists looking for federally protected species, including plants; however, bats would unlikely be detected.

Occasionally, a situation may occur during prescribed fire that requires mop-up and containment to keep the fire from getting outside containment lines, as mentioned above. In the case of wildfire, conditions and locations are judged on a case-by-case basis and snags that can cause candling (sparks emitting from the top of a tree or snag) and may ignite another fire when sparks are carried on the wind are removed. Mop-up involves making sure tree stumps and hot spots are out using rakes and/or water.

Maximum annual activities for consultation:

- Prescribed fire (250,000 acres)
- New fireline construction (130 acres)
- Fireline preparation total (total 500 acres)
- Active season fire line construction and preparation (80 acres)

2.4. Forest Site Clearing

Numerous small-scale, non-timber projects involve tree clearing. These include road, trail and parking lot construction, mineral development, and pond construction and maintenance. This type of work usually involves heavy equipment to remove standing trees.

In general, road management entails the maintenance or improvement of existing corridors (reconstruction) rather than establishing new roadways (construction). The primary focus is on

maintaining and rehabilitating the existing road system. Maintenance priorities include bridge safety, adequate signs, suitable stream crossings, and any resurfacing or reconstruction needed to provide an overall road system that is useable and safe. Road maintenance includes brushing, surfacing, culvert and bridge replacement, and grading to assure safe public access within the Forests. Both road reconstruction and construction can remove trees, but generally road maintenance does not remove trees, unless the tree poses a safety hazard. The assumptions for tree removal needed are approximately 3 acres per mile for road construction and about 0.5 acre per mile for road reconstruction. Clearing for roadwork may involve clearing for a re-routed road, a new stream crossing alignment, or as an equipment staging area during construction. When roads are rerouted, the original roadbed is reclaimed and managed as forest. Most temporary roads are pre-existing from a former timber sale or user created roads that are not recognized or maintained by the Forest. Usually, temporary road work requires removal of trees and shrubs less than 10 years old. Trail construction, reconstruction and maintenance typically involve removal of small diameter trees (<8 inches DBH). Clearing areas are typically less than 10 feet wide and maintained as short, non-woody vegetation. New trail would require 1 acre of clearing per mile of trail. Hazard tree removal may also be required for visitor safety. The Forest average of new road construction is 5 miles (15 acres) per year, road maintenance averages 3,650 miles (1,825 acres) and temporary roads (75 miles or 8,437 acres). The Tiak unit in Oklahoma will perform road daylighting/wildfire break over the next 10 years for 175 acres.

Wildlife habitat opening creation or expansion, pond creation or reconstruction, glade restoration, stream or lake habitat enhancement, and soil and water protection projects typically involve tree clearing or create or improve special habitats. Wildlife openings provide early successional habitat conditions and favorable foraging opportunities for wildlife game species. Most wildlife openings are 1 – 5 acres in size and are managed in a grassland condition. Initial tree removal may be completed as a timber operation and then the stumps are removed from the ground to allow future management by tractor, or whole trees are pushed by heavy equipment. Pond creation and reconstruction is conducted with heavy equipment to remove trees and other vegetation and earthwork. Reconstruction and maintenance of ponds may only occur every couple of decades, and trees have often grown to larger sizes on the banks and dams that need to be removed when restoring ponds. Glade restoration typically involves removal of trees to restore historically open habitats in areas with very shallow soils. Cedar trees are the most common encroaching vegetation, but in some cases, pine trees or hardwoods are also thinned. Prescribed fire is typically used to maintain the open glade conditions.

The Forest removes trees or authorizes permittees to remove trees to meet management needs beyond ecological restoration. These generally affect small areas or linear corridors and include maintenance or development of recreation areas, special uses, minerals development activities, right-of-way creation or maintenance, dam maintenance, grazing infrastructure maintenance, and recreation site maintenance.

Recreation management sometimes requires clearing small acreage areas for updating or increasing the size of parking areas, rerouting or adding additional facilities and management of utilities and other administrative site's needs. Management for recreation activities on the Forest will address maintenance needs on hiker and bike trailheads, hunting and fishing access points, and developed sites such as campgrounds and parking lots. Actions would include removal of

hazard trees, and limited removal of trees during facility development or maintenance. Most of the hazard tree removal of recreation sites occurs during the season that the facilities are closed, which occurs mostly during the hibernation season of the four bats. Vegetative treatments like mowing and non-native, invasive species (NNIS) treatments will occur during the summer when recreation sites are open. In rare cases, such as following storms that have damaged trees, hazard tree removal may be needed during the non-volant period. Developed recreation sites would stay approximately the same number and size, otherwise, a special consultation with the AFO or OFO may be necessary; for example, this BA will cover details of a unique recreational project (see below) proposed to occur on the Forest. The Forest and Service determined that including these project specific details in this programmatic consultation was an appropriate path to ensure any effects of the action are covered.

The Forest issues special use authorizations for multiple purposes to individuals, corporations, and other government agencies. The predominant uses are for public roads, communication facilities, oil and gas leasing, and utility rights-of-way. Maintenance activities are predominantly road or utility line corridor maintenance, which includes hazard tree removal and maintenance of grass/forb and shrub communities within the right-of-way by mowing and herbicide application. Most of the acreage in this category involves clearing of trees less than 5 years in age; however, large limbs can be cut with brush cutters to avoid limbs touching powerlines that cross the Forest. The Forest currently has 149 miles of powerline that might be trimmed and cause the potential to affect roosting bats, like the tricolored bat, which typically roost within the leaf clusters of trees. Oil and gas development involves clearing trees and other vegetation for drill pads or other facilities and can result in openings 1 – 5 acres in size. These sites can remain in production phase for many years, and they are reclaimed and revegetated when the production is complete. Exclusions are made for developed recreation areas, research natural areas, national natural landmarks, experimental forests, rare upland communities, and old growth core areas.

The Mena Trails Project, encompassing up to 8,196 acres on the Forest, will be authorized through a special use permit and could occur over a 10-year period. The chosen alternative will consist of construction of ≤ 100 miles (125 acres of permanent and 250 acres of temporary) of primarily natural surface trails, construction of three chair lifts (with 80-foot-wide corridors) (chair lifts will use 47 acres and base portals 30 acres), development of a base portal (25 acres), construction of parking areas and improvements to the existing pull-offs (i.e., vistas) along Arkansas Highway 88 (102 acres), development of uplift (i.e., chair lift) infrastructure (such as powerlines) and improvement of existing road segments (13 acres). This project could occur over a 10-year period. No talus slope will be disturbed with this alternative. Activity levels, per year, may depend on budget, contractor work periods, equipment available, use and recreational activity of the trail as work is completed.

For a full description of activities and analysis of effects to bats see the Mena Trails Biological Evaluation (BE) (Garver, 2024). The BE discusses vegetation disturbance, tree removal and components of noise from construction and vibrations of mechanical equipment, possible blasting, and increased lighting. Based on that analysis, the Forest determined that all activities associated with this project (herbicide, mowing, limbing, increased light, noise) other than forest clearing are not likely to adversely affect bats, but taking of trees by forest clearing is likely to adversely affect the covered bats.

Crystal mining permits on the Forest vary depending upon the demand for quartz crystal. At various times there have been as many as 150 permits open at one time, and as few as 19 open. Recently the Forest has seen a dramatic increase in the interest in quartz crystal mining; where after 13 years of no new permits being issued, since 2017 there have been 14 new quartz contracts issued with 4 additional contracts in the final review phase, and about 12 more current applications. Quartz crystal can be found on the Caddo-Womble, Jessieville-Winona-Fourche and Mena Oden units. The Kiamichi unit in Oklahoma has a moderate quartz potential. Sizes of quartz permits range from 10 acres to 160 acres, with the sizes of their surface disturbance ranging from 0.1 – 11 acres. Manganese, turquoise, iron phosphates, as well as other minerals have been mined historically on the Caddo, Mena, Poteau and Womble units. There are currently 41 aggregate pits across the Forest with about 160 acres of surface disturbance, ranging in size from 1 acre to >50 acres in surface disturbance, with 1 pit currently in the development stage, as well as several pits undergoing NEPA process to add at least 25 new acres of surface disturbance if approved. Additionally, there are several other hardrock leases and mining claims across the Forest with varying levels of activity, currently most are 1 – 2 acres in size, if they have any disturbance at all. Certain areas are excluded from mining like wilderness areas, water and riparian communities (for quartz but not hardrock leases or locatable minerals), wild and scenic rivers (quartz and aggregate allowed but not locatable minerals) experimental forests (research natural areas), national natural landmarks and the Winding Stair Mountain National Recreation and Wilderness Area in Arkansas and Oklahoma. On lands deemed suitable, a miner can clear timber to conduct mineral exploration and operations; depending upon the management area (MA) and other factors identified in the NEPA analysis, the disturbances can be limited to as little as 0.5 acre unreclaimed at any one time, to larger surface disturbances. All significant surface disturbing operations require a reclamation bond in place and all operators are required to reclaim all areas upon completion of their operations. Mining restrictions across the Forest are dictated in part by the MA in which the operation is taking place, and by the mineral status, as some restrictions apply to locatable minerals, but not leasable or salable minerals and vice-versa. Some MA restrictions limit surface disturbances to no more than 0.5 acre unreclaimed at any one time, while others MA's have no pre-existing restrictions on them. Reclamation involves earthwork, if needed, and replanting appropriate trees. The standard for reclamation of mine sites is to remove any mining related hazards and return the site to a natural looking state – returning the surface disturbance to the original topography is not a requirement.

Maximum annual activities for consultation:

- Forest site clearing: 500 acres (Mining, pond building, wildlife opening building, special uses, etc.)
- Forest clearing for roads and maintenance: 10,277 acres (new road construction, road daylighting, maintenance, and temporary roads)

2.5. Individual Tree Removal

Individual tree removal covers projects that involve removing few trees or scattered trees that are more easily quantified by a count of trees removed than acres cleared. Trees being removed may include either live or dead trees. Removal of individual trees is commonly accomplished with a chainsaw, but in some cases heavy equipment may be used to push a tree over. Some examples include hazard trees that need to be removed from recreation areas, rights of way, and administrative areas for the safety of workers or the public or due to risk of damage to

infrastructure. Recreation area hazard trees are routinely assessed and removed during the winter months, when sites are closed to the public or have few forest users. In some cases, trees become a hazard during the active season and immediate removal may be required (~100 trees per year).

Maximum annual activities for consultation: 1,100 active season removals of individual trees

2.6. Mowing, Brush Removal, and Herbicide

Mowing, brushing, and herbicide applications are used to maintain areas in a condition of low-growing vegetation, such as grass, shrubs, or small trees. Areas that receive mowing treatments include, developed recreation sites, administrative sites, wildlife openings, rights-of-way for roads, pipelines, and utilities. Mowing may include lawnmowers, weed eaters, or tractor pulled brush hogs. Although some small trees may be mowed, they are unlikely to provide roosting habitat for bats. Within the proclamation boundary of the Forest, there are approximately 5,786 miles of road, 279 miles of powerline, 209 miles of aerial telephone line, 58 miles of fiber optic cable and 28 miles of gas pipeline. The width of vegetation management area depends on the use and right-of-way width according to the specific use. Some of these lines may overlap, for instance, a telephone company attaching lines to an existing power pole. Trees near overhead lines are typically trimmed once every 5 years.

Brush removal involves cutting of small diameter woody stems or limbs to create and maintain forest openings. Although this work can be done with powered hand tools like trimmers or weed eaters with rotating blades and chainsaws, it is more commonly accomplished with a brush head with rotating blades mounted on heavy equipment, such as a tractor, skid steer, or excavator. Brush removal can cut vegetation at the ground level or side-trim trees to remove limbs that are growing into a right-of-way. Limbing and brushing taller trees is typically conducted on overhead utility lines and occasionally along roads. Brush removal and limbing typically occurs every 5 – 10 years to maintain rights-of-way conditions.

Herbicide is used to control select species or groups of species to maintain desired vegetation on a site. Herbicide is applied for forestry applications, including foliar spray, stem injection, hack-and-squirt, and cut-stump treatments. In open lands settings, herbicide is used to control non-native, invasive plants, and woody species. This occurs primarily near roadsides, along rights-of-way, in wildlife openings, and areas that are managed in an open condition, such as glades. The Forest is not allowed foliar spray anything over 6 feet in height, which limits the DBH to very small numbers. Most shrubs and trees over waist high are cut and stump sprayed or scarred with an axe or machete and chemical is directly applied.

Maximum annual activities for consultation:

- 6,200 acres of mechanical treatment
- 6,600 acres of chemical treatment
- 300 acres of limbing of mature trees

2.7. Bridge and Culvert Replacement

Maintenance, repair, or replacement of existing transportation structures (e.g., bridges and culverts) with the potential to be used by bats shall be conducted when bats are not present. The absence of bats may be determined by either a visual survey by a qualified biologist or by the

timing of activities. Occupancy survey methodologies for transportation structures shall be consistent with those used by the local state Department of Transportation. If a bat survey indicates no federally listed bat species are present in these structures, the work may occur year-round. If any of the four bat species are present, individual consultation would be necessary.

2.8. Range Allotment Management

Since the 2005 Forest Plan, the Forest has slowly closed all range leases except for in Oklahoma. Oklahoma has two range allotments, the Buffalo Creek Allotment in McCurtain County at 17,500 acres and the Sycamore Allotment at 9,200 acres. Actions often required are occasional fence repair, thinning in forested areas and mowing, pond construction, prescribed burning and non-native invasive species (NNIS) plant control. Activities such as thinning, pond construction, and prescribed burning on these areas are accounted for in the above-mentioned estimates for these activity types.

2.9. Cave Gating

Signage, gates, and fences are effective ways to control access to caves and abandoned mines. However, without proper planning with bat movement in mind, gates can serve as a barrier to bats, and in some cases, may restrict airflow and impact the hibernaculum's internal temperature (Currie 2002, Herder 2003, Pugh and Altringham 2005, Spanjer and Fenton 2005, and Tobin and Chambers 2017). District biologists will work with sub-regional mine specialist/geologist to get bat friendly gates funded, fitted, and placed and installed where necessary. Hibernaculum Management Plans will be developed for each with specific instructions. The Forest will coordinate with the Service in advance of any new gate installation or existing gate maintenance occurring on caves or mines that have historic or current records for either of the four species.

2.10. Building Maintenance and Removals

Manmade structures can have maternity colonies using them. These roosts can end up being an important feature for bat habitat conservation. Buildings and other manmade structures can be used as a roost for males and all bats outside of the maternity period. With climate warming, this might include winter use instead of a normal hibernaculum. Bats may exhibit site fidelity to many of these locations, so finding and protecting these sites can improve conservation efforts. The recommendation for bridges and culverts is the same for buildings (including old vault toilets). If found, revisit known non-maternity roost(s) to determine continued usage. If bats can be readily observed in buildings, visual inspection by a biologist may be sufficient for monitoring. If bats cannot be easily observed, consider emergence counts to determine continued site use. In cases where one of the four species is found, coordination and possible individual project consultation with the Service will be implemented.

2.11. Conservation Measures

2.11.1. General Forest Management

- Tiak Unit: Chemical herbicide applications conducted for the removal of trees less than 8 in (20.3 cm) DBH will be restricted to August 16 – March 31 within the covered species roost tree buffers.

- Tiak Unit: All mechanical removal of trees (excluding known roost trees), including forest management actions such as site preparation for tree planting, timber stand improvement, seed tree regeneration harvest, commercial thinning harvest, mid-story reduction, small-scale clearing (e.g., pond creation), temporary road construction, and road daylighting, will be restricted to August 16 – March 31 within the covered species roost tree buffers.
- Retain all snags unless removal is required for safety or prevents implementation of an authorized construction or vegetation management activity. For example, snags may be removed to clear landings, to clear areas for construction, to remove snags that would fall across a road or fireline, or other operationally required elements or if they would threaten worker or public safety in high traffic and developed recreation areas.
- Develop strategies in prescribed fire burn plans to prevent excessive heat and smoke impacts to hibernacula. All hibernacula would be individually evaluated by fire staff and a Forest biologist prior to the burn to determine if special preparation or ignition strategies are needed to protect hibernacula.
- Fireline snag removal for prescribed fire shall not occur during the pup season (May 15 – July 31) unless the snag threatens containment in a way that cannot be addressed by removal of fuels from the base of the snag.
- Harvesting of snags or green trees is allowed during salvage operations. Retention of at least 9 snags per acre, if available, is required choosing the largest size class or best bat roost characteristics unless removal is required for insect and disease containment or safety.
- For insect and disease outbreaks within the hibernacula and roost buffers, remove the minimum number of trees required to prevent or contain the spread. Adhere to established timing restrictions for tree and snag removal in the buffers. If it is critical to remove trees during the seasonally restricted period, individual consultation with the Service will be initiated.
- If bats are occupying a building or other anthropogenic structure, determine if the bats present are one or more of the covered species with a survey by a Forest or Service biologist. If a covered species is present, it will be outside the scope of this consultation and further coordination with the Service will be required.
- In addition to TE002, in the Forest Plan, blasting, pile driving, geotechnical drilling, and similar activities that create a noticeable vibration or change in noise level are prohibited within 0.5 mile of a hibernaculum during the hibernation period or at any distance throughout the year that would threaten the structural integrity of a hibernaculum.
- Survey for the covered species prior to major repair or demolition of bridges or concrete culverts over 3 feet in diameter. If one of the covered species is present, it will be outside the scope of this consultation and further coordination with the Service will be required.

2.11.2. Maternity Roost Zone Protection

- In a maternity roost zone (MRZ), tree cutting will not be conducted if it would cause greater than 10% of the MRZ to have a basal area of less than 40. Areas of tree

cutting within a MRZ will not exceed 10% of the MRZ during a 3-year period. Exceptions require individual consultation.

- If Indiana bat maternity trees are discovered within the Forest, those trees and other trees used by the colony would be protected. No tree falling would occur within 150 feet of known IBAT maternity trees unless their cutting or modification is needed to protect public or employee safety. Where tree cutting or modification is deemed necessary within this area, it must be coordinated with the USFWS. The need for individual consultation would be evaluated on a case-by-case basis.
- Prior to prescribed fire, fuels would be removed from around known maternity trees to prevent damage during burning in dormant to protect integrity of structure.
- During the maternity period (May 1 – August 15), activities that may disturb the colonies, such as timber harvest, use of heavy equipment, and prescribed fire would be prohibited in an area approximately .7 miles for IBAT and LBBA and 0.25 mile from known NLEB and TRBA from known maternity roost trees. Exceptions may be made where coordination with the AFO/OFO determines these activities to be compatible with recovery of the species and would not have effects beyond those evaluated in this consultation. Exception dates for Tiak Unit: April 1 – July 31.
- New permanent developments within Maternity Roost Zones (see Table 2-1 for distances), such as construction of new roads, motorized trails, pastures, or special use right of ways, are excluded from this consultation. Exceptions may be made when coordination with the Service determines these activities to be compatible with recovery of these species and would not have effects beyond those evaluated in this consultation.

Table 2-1. Roost Zone (maternity and non-maternity) buffer distances around sites demonstrating evidence of use by the covered species. A maternity tree is best determined through multiple lines of evidence including radio-tracking a reproductive female or a juvenile bat to the tree during summer activity season (DNA sampling, emergence counts, samples of guano below roost, mist netting or acoustic survey near a tree to determine species of use). If a reproductive female is captured but is not tracked to a roost, apply the larger buffer until a specific roost tree can be identified.

Bat Species	Maternity Roost Zone Distance Around Known Maternity Roosts	Maternity Roost Zone Distance Around Reproductive Capture (includes volant juveniles)	General Non-Maternity Roost Protection
Indiana Bat	0.7 mile	1.8 miles	150 feet
Little Brown Bat	0.7 mile	1.8 miles	150 feet
Northern long-eared Bat	0.25 mile	0.75 mile	150 feet
Tricolored Bat	0.25 mile	0.75 mile	150 feet

2.11.3. General Roost Protection

- Tree cutting is prohibited within 150 feet of a known roost tree from April 1 – August 15 within the non-maternity roost zone. Tree removal is typically only conducted to enhance the condition of the roost tree or for safety. Exceptions may be made when coordination with the Service determines these activities to be compatible with recovery of these species and would not have effects beyond those evaluated in this consultation. This BA adopted the Tiak Unit timeline due to soil conditions in areas requiring management (see map in appendix).
- Known roosts will be safeguarded and protected from intentional damage or destruction at all times of the year. Emergency roost removal (e.g., human safety concerns) will require individual consultation. If necessary, for safety, consultation may occur after the removal takes place.
- Artificial roost structures or manmade roosts will be treated the same as roost trees and follow buffer guidelines.

2.11.4. Hibernacula Protection

- Establish a 500-foot Cave/Mine Management Zone (CMMZ) around any cave/mine entrances that could provide potential roosting habitat for bats.
- Within CMMZs no tree cutting, road construction or other significant disturbance will occur without individual consultation with the AFO/OFO.
- Removal of live or dead trees that are potential roosting habitat for bats is prohibited in the hibernacula buffers during the spring staging (March 2 – April 30) and fall swarming (August 15 – Nov 30) periods unless an emergence survey is conducted on the tree the evening before removal to determine that no bats are present.
- Prohibit prescribed fire in the hibernacula buffers during the fall swarming period (August 15 – November 30) if temperatures are less than 50° F or relative humidity is greater than 40%.
- Within 500 feet of the covered species hibernacula, new permanent development, such as construction of roads, motorized trails, wildlife openings, pastures or special use right of ways are excluded from this consultation. Exceptions may be made where coordination with the Service determines these activities to be compatible with recovery of these species and would not have effects beyond those evaluated in this consultation. Individual consultation with the Service may be sought in special circumstances.
- White-nose syndrome decontamination protocol shall be required for any underground access.
- During swarming and staging, within the buffers, (Table 2-2), use targeted pesticide application methods in suitable roost habitat to treat NNIS like spot spraying or stump cut to minimize affecting non-target plants and animals.

Table 2-2. Hibernacula buffers based on abundance of species using the site. Bat abundance is determined by the highest estimated number of bats using the site in the past six years. For moderate to high abundance sites, a count every other year is preferred. Direct winter counts are expected to be the most common and are typically the most accurate for estimation of all species except NLEBs. Because of the low detection rate of NLEB using this method, when that species is detected during winter counts, it is assumed that others are present but not detected. Indiana bat hibernacula protection buffers are protected by Forest Plan Standard TE006 (Appendix A) around Bear Den Cave.

<u>Species</u>	<u>Low Abundance</u>	<u>Buffer Distance</u>	<u>Moderate to High Abundance</u>	<u>Buffer Distance</u>	<u>Potential Habitat (cave or mine)</u>
Indiana bat	1-9	0.25 miles	10+	2 miles	500 feet
Little brown bat	1-9	0.25 miles	10+	2 miles	500 feet
Northern long-eared bat	Historic occupancy	500 feet	1+	0.25 miles	500 feet
Tricolored bat	1-9	500 feet	10+	0.25 miles	500 feet

2.11.5. Required Survey and Monitoring

- Meet at least once every two years with the AFO, Arkansas Game and Fish Commission (AGFC), OFO, Oklahoma Department of Wildlife Conservation, Ozark National Forest, and other bat conservation partners to prioritize and coordinate survey and conservation projects on the OUF.
- Conduct internal visual surveys of any hibernacula that have historical presence of the four species at minimum every five years. For mines that have gates without openings or determined unsafe for human entrance, acoustic equipment should be used for at least a consecutive 2-week deployment within the months of October 1 – November 15 or March 1 – April 30. Potential use by any of the 4 species would be followed up with additional monitoring like emergence counts, harp traps, etc.
- Employ stationary acoustic monitoring or bat netting surveys at a minimum of 100 sites every five years to search for occupied habitats of priority bat conservation species across the Forest. Focus will be on areas without adequate prior surveys or to improve information in areas with suspected bat use. Prioritize mist-net surveys in areas with acoustic detections that indicate occupancy by IBAT, NLEB, LBBA, and TRBA. If reproductive females of these species are caught during mist-net surveys, use radio tracking to locate specific roost sites or protect these sites as Maternity Roost Areas. Survey priorities and acoustic detection follow up level of effort will be coordinated with both AFO and OFO with preference initially being placed on spring emergence or fall swarming dates.

2.11.6. Survey and Monitoring Recommendations (not required)

- Mines or caves that have been determined by the Forest, the AFO/OFO, or AGFC as potential hibernacula with no historical data should be surveyed with acoustic equipment

every 5 years, 20% of all potential hibernacula per year, for at least 2-week consecutive deployment within the months of October 1 – November 15 and March 1 – April 30.

- Efforts will be made to survey “moderate to high abundance” or significant (as deemed by the Service) colonies every two years.
- The Forest should support continued efforts to perform site evaluations of new potential mines/cave found across the Forest using LIDAR, similar to ongoing work funded by AGFC. When new mines are located using this methodology, acoustic monitoring should follow to determine bat use.

2.12. Other Activities Caused by the Action

A BO evaluates all consequences to species or critical habitat caused by the proposed Federal action, including the consequences of other activities caused by the proposed action, that are reasonably certain to occur (see definition of “effects of the action” at 50 CFR §402.02).

Additional regulations at 50 CFR §402.17(a) identify factors to consider when determining whether activities caused by the proposed action (but not part of the proposed action) are reasonably certain to occur. These factors include, but are not limited to:

- (1) past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action,
- (2) existing plans for the activity, and
- (3) any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

In its request for consultation, the Forest did not describe, and the Service is not aware of, any additional activities caused by the Action that are not included in the previous description of the proposed Action. Therefore, this BO does not address further the topic of “other activities” caused by the Action.

2.13. 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” (50 CFR §402.02). Delineating the action area is necessary for the Federal action agency to obtain a list of species and critical habitats that may occur in that area, which necessarily precedes any subsequent analyses of the effects of the action to species or critical habitats.

It is practical to treat the action area for a proposed Federal action as the spatial extent of its direct and indirect “modifications to the land, water, or air” (a key phrase from the definition of “action” at 50 CFR §402.02). Indirect modifications include those caused by other activities that would not occur but for the action under consultation. The action area determines any overlap with critical habitat and the physical and biological features therein that we defined as essential to the species’ conservation in the designation final rule. For species, the action area establishes the bounds for an analysis of individuals’ exposure to action-caused changes, but the subsequent consequences of such exposure to those individuals are not necessarily limited to the action area.

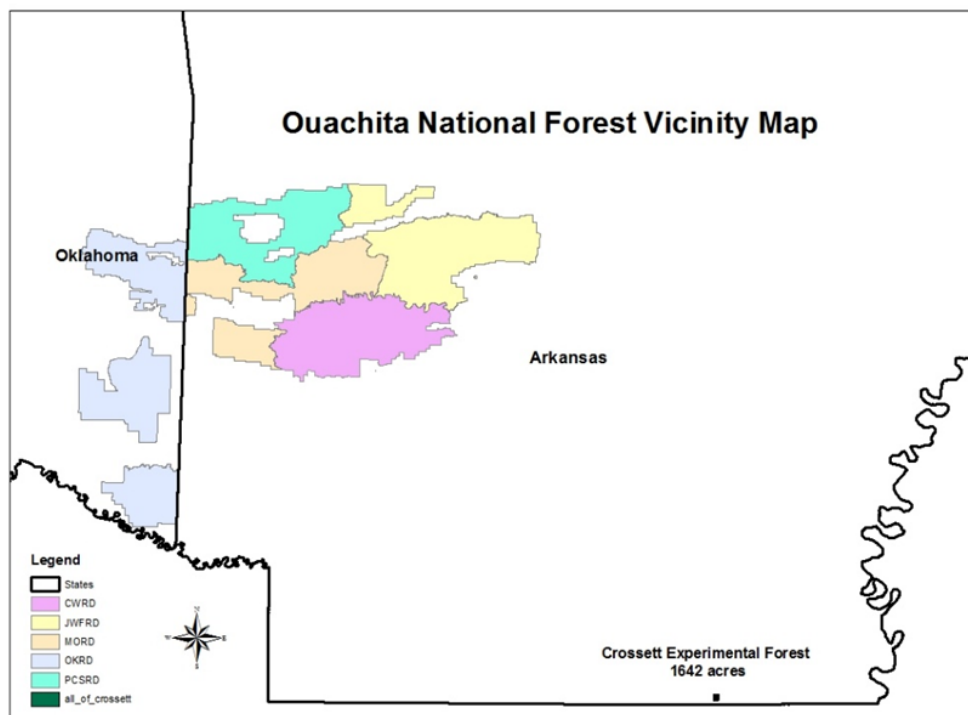


Figure 2-1. The Action Area includes all Forest owned tracts in Arkansas and Oklahoma.

Figure 2-1 shows the locations of all activities that the proposed Action would cause and the spatial extent of reasonably certain changes to land, water, or air caused by these activities, based on the descriptions and analyses of these activities in sections 2.1–2.11. The Action Area for this BO includes approximately 1.8 million acres of National Forest System lands occurring in western Arkansas and southeastern Oklahoma. The Forest is divided into five ranger districts and occurs in the following counties: Ashley, Garland, Hot Spring, Howard, Logan, Montgomery, Perry, Pike, Polk, Saline, Scott, Sebastian, and Yell Counties in Arkansas, and LeFlore and McCurtain Counties in Oklahoma.

3. SOURCES OF CUMULATIVE EFFECTS

A BO must predict the consequences to species caused by future non-Federal activities within the action area, *i.e.*, cumulative effects. “Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation” (50 CFR §402.02). Additional regulations at 50 CFR §402.17(a) identify factors to consider when determining whether activities are reasonably certain to occur. These factors include but are not limited to: existing plans for the activity; and any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

In its request for consultation, the Forest did not describe, and the Service is not aware of, any future non-Federal activities that are reasonably certain to occur within the Action Area. Therefore, we anticipate no cumulative effects that we must consider in formulating our opinion for the Action.

4. STATUS OF THE SPECIES

This section provides the Service's biological opinion of the Action for IBAT, NLEB, and TRBA.

4.1. Status of Indiana Bat

This section summarizes best available data about the biology and condition of the IBAT throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list the IBAT as endangered on March 11, 1967 (32 (48) FR 4001).

4.1.1. Species Description

The IBAT is a temperate, insectivorous, migratory bat of the family *Vespertilionidae* that hibernates in caves and mines in the winter and summers in forested areas. It is a medium-sized bat, having a wingspan of 9 to 11 inches and weighing only one-quarter of an ounce. It has brown to dark-brown fur; the facial area often has a pinkish appearance. The IBAT closely resembles the LBBA and NLEB. It is distinguished from these species by its foot structure and fur color.

4.1.2. Life History

The life cycle of IBAT is summarized in Figure 4-1. The species hibernates in caves and mines in the winter (typically October through April) and migrates to forested summer habitat. When arriving at their traditional hibernacula in August-September, IBATs "swarm" for several weeks prior to hibernation. Some male bats may begin to arrive at hibernacula as early as July, but females typically arrive later. The highest swarming activity in Indiana and Kentucky is early September (Cope and Humphrey 1977). Swarming is a critical part of the life cycle when IBATs converge at hibernacula, mate, and forage to store sufficient fat reserves have been deposited to sustain them through the winter (USFWS 1983). Swarming behavior typically involves large bat numbers flying in and out of cave entrances throughout the night, while most bats continue to roost in trees during the day (Cope and Humphrey 1977). Body weight may increase by 2 grams within a short time, mostly in the form of fat. Copulation occurs on cave ceilings near the entrance during the latter part of the swarming period (USFWS 2007). Females may mate their first autumn, whereas males may not mature until the second year (USFWS 2007). By late September, many females enter hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females.

Hibernation initiation may vary by latitude and annual weather conditions. However, most bats hibernate by the end of November (USFWS 2007). Hibernation facilitates survival during winter when insect prey is unavailable. Hibernating IBATs cluster on cave ceilings in densities of approximately 300-484 bats/ft², from approximately October through April. Clusters may protect individuals from temperature changes and reduce sensitivity to disturbance. Like other cave bats, the IBAT naturally arouses during hibernation (Sealander and Heidt 1990). Arousals are more frequent and longer at the beginning and end of the hibernation period (Sealander and

Heidt 1990). Limited mating occurs throughout the winter and in early April as bats emerge (USFWS 2007).

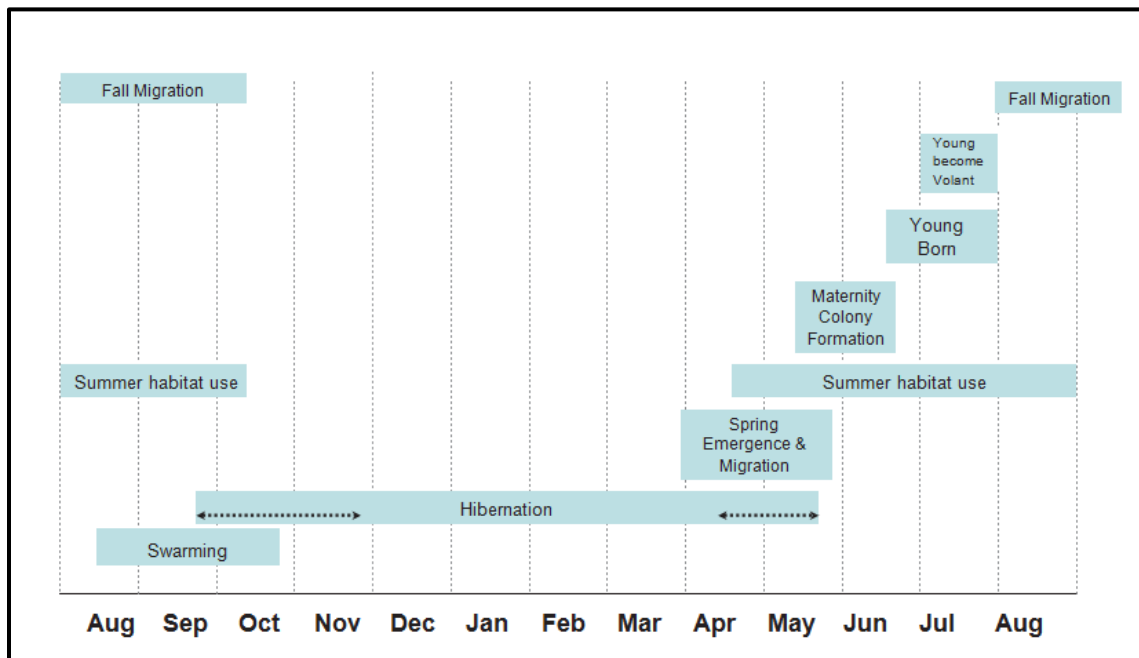


Figure 4-1. Indiana Bat Annual Chronology (USFWS 2007)

Spring emergence occurs when outside temperatures increase and insects (prey) are more abundant (Richter et al. 1993). Most IBATs emerge in late March or early April; the timing of annual emergence may vary across the range depending on latitude and annual weather conditions. Females emerge before males. Shortly after emerging from hibernation, the females become pregnant via delayed fertilization from the sperm that has been stored in their reproductive tracts through the winter (USFWS 2007). During the “staging” period, the bats forage for a few days or weeks near their hibernaculum before migrating to their traditional summer roosting areas. Most populations leave their hibernacula by late April. Migration is stressful for the IBAT, particularly in the spring when their fat reserves and food supplies are low. As a result, adult mortality may be the highest in late March and April.

Most published literature indicates IBATs migrate north for the summer maternity season (USFWS 2007, Gardner and Cook 2002). However, recent migration studies also document lateral and southward migrations (Copperhead 2017, Copperhead 2018, Copperhead 2019, Roby et al. 2019). Some reproductive females migrate up to 357 miles (Winhold and Kurta 2006) to form maternity colonies, while others form maternity colonies within a few miles of their hibernacula (U.S. Army Garrison Fort Drum 2011). Males and non-reproductive females roost individually and in colonies (Hall 1962, Carter et al. 2001, Whitaker and Brack 2002). Males are commonly found roosting near the hibernacula and migrate long distances to their summer habitat (Kurta and Rice 2002).

Female IBATs give birth to one young each year (Mumford and Calvert 1960, Humphrey et al. 1977, Thomson 1982). The proportion of female IBATs that produce young is not well documented. At a colony in Indiana, 23 of 25 female IBATs produced volant young during one year and 23 of 28 females the following year (Humphrey et al. 1977). Based on cumulative

mist-netting captures over multiple years, Kurta and Rice (2002) estimated that 89% of adult females in Michigan maternity colonies were in reproductive condition (pregnant, lactating, or post-lactating). Racey (1982) notes that a particular ratio of fat to lean mass is normally necessary for puberty and the maintenance of female reproductive activity in mammals. He suggests further that the variation in bat puberty age is due to nutritional factors, possibly resulting from the late birth of young and their failure to achieve threshold body weight in their first autumn. Once puberty is achieved, reproductive rates frequently reach 100% among healthy bats of the family *Vespertilionidae* and young, healthy female bats can mate in their first autumn, as long as their prey base is sufficient to allow them to reach a particular fat to lean mass ratio.

Studies by Belwood (2002) show asynchronous births among members of a colony. This results in great variation in juvenile size (newborn to almost adult size young) in the same colony. Young IBATs are capable of flight within a month of birth. Young born in early June may be flying as early as the first week of July (Clark et al. 1987), with others flying from mid- to late July. Mortality between birth and weaning was found to be about 8% (Humphrey et al. 1977).

The average life span of the IBAT is 5 to 10 years, but some individuals may live as long as 15 years (Humphrey and Cope 1977). Using winter sampling of unknown-age bats over a 23-year period, Humphrey and Cope (1977) estimated annual survival. Female survivorship in an Indiana population was 76% for ages 1 to 6 years and 66% for ages 6 to 10 years. Male survivorship was 70% for ages 1 to 6 years and 36% for ages 6 to 10 years. Following 10 years, the survival rate for females dropped to 4% (Humphrey and Cope 1977).

4.1.3. Numbers, Reproduction, and Distribution

Indiana bat occurs throughout most of the eastern United States. The recovery program for the IBAT delineates four Recovery Units (RUs): the Ozark-Central, Midwest, Appalachian Mountains, and Northeast RUs (USFWS 2007). Because the vast majority of IBATs form dense aggregations or “clusters” on the ceilings of a relatively small number of hibernacula (i.e., caves and mines) each winter, conducting standardized surveys of the hibernating bats during that time is the most feasible and efficient means of estimating and tracking population and distribution trends across the species’ range. Collectively, winter hibernacula surveys provide the Service with the best representation of the overall population status and relative distribution that is available.

The data regarding IBAT abundance prior to federal listing are limited, but the information suggests that IBAT was once far more abundant than they were in the 1960s. Tuttle and colleagues, for example, believe the overall abundance of IBAT likely rivaled that of the now extinct passenger pigeon (USFWS 2007). The basis for the estimates of millions of IBATs prior to European settlement is primarily historical accounts (e.g., Blatchley 1897, Silliman et al. 1851), extensive staining left on the ceilings of several historical hibernacula (Tuttle 1997, 1999), and other paleontological evidence (Munson and Keith 1984, Toomey et al. 2002). For example, an analysis of bone deposits in Bat Cave, Kentucky revealed an estimated 300,000 IBATs died during a single flood event at some point in history (Hall 1962).

When the IBAT was originally listed as endangered in 1967, there were approximately 883,300 bats, and most of these hibernated in a small number of hibernacula (Clawson 2002). Since the species was listed, its population numbers have apparently continued to decline through approximately 2001. Although some winter bat surveys began as early as the late 1950s, systematic surveys were not conducted across the range until the mid-1980s when there were an estimated 678,750 IBATs (Clawson 2002). Since being listed, large population declines occurred especially at hibernacula in Kentucky and Missouri. Caves in Kentucky suffered dramatic losses due to changes in microclimate caused by poor cave gate design at two of the three most important hibernacula (Humphrey 1978), and IBAT numbers in Kentucky hibernacula continued to decline until 2005 (USFWS, unpublished data, 2007). Despite recovery efforts, IBAT in Missouri caves declined with a loss of more than 80% of the previous population size (Clawson 2002). The range-wide population estimate dropped approximately 57% from 1965 to 2001 (USFWS 2007).

The range-wide, biennial population estimates were increasing from 2001 – 2007, indicating an arrest to the species’ long-term decline (USFWS 2019). However, declines since 2007 are attributable to White-Nose Syndrome (or “WNS”; see discussion below), especially in the Northeast Recovery Unit. The Service estimated the 2022 rangewide population at 596,431 bats (Figure 4-2) occurring in 223 hibernacula in 16 states, with the 3 most populous states being Missouri (228,333), Indiana (219,459), and Illinois (77,196). This represents a 10.3% decrease from the 2007 (WNS begins) range-wide population estimate of 664,637. However, there has been an 11% increase since the 2019 survey.

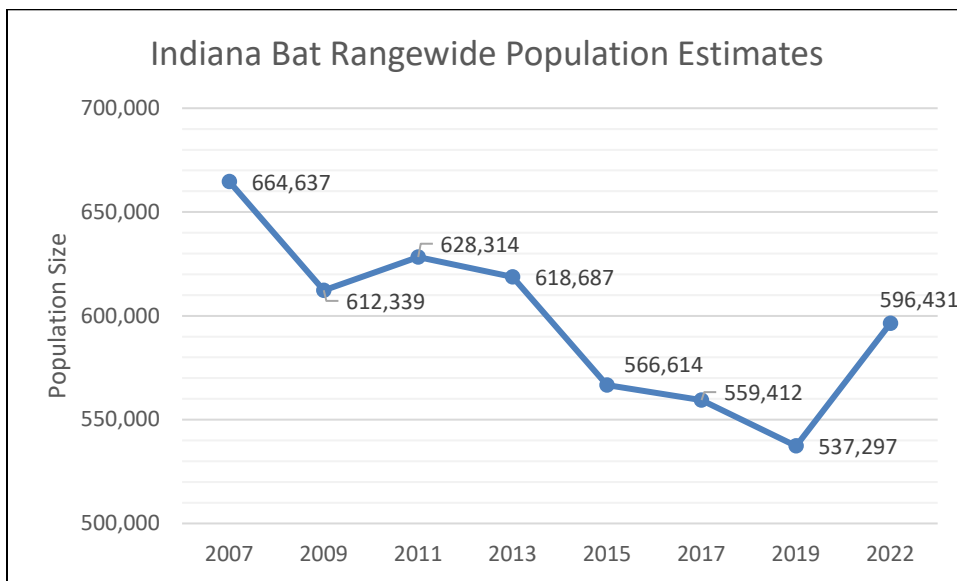


Figure 4-2. Indiana bat range-wide population estimates from 2007-2022.

Summer distribution of IBAT occurs throughout a wider geographic area than its winter distribution. Most summer occurrences are from the upper Midwest, including southern Iowa, northern Missouri, much of Illinois and Indiana, southern Michigan, Wisconsin, western Ohio, and Kentucky. In the past decade, many summer maternity colonies have been found in the northeastern states of Pennsylvania, Vermont, New Jersey, New York, West Virginia, and Maryland. Maternity colonies also occur in the south, including northern Arkansas, Georgia,

Alabama, Mississippi (Roby et al. 2019, Copperhead 2019), and southwestern North Carolina (Britzke et al. 2003, USFWS 2007). Non-reproductive summer records exist for eastern Oklahoma, northern Mississippi, Alabama, and Georgia.

4.1.4. Conservation Needs and Threats

Destruction/Degradation of Hibernacula

There are well-documented examples of modifications to IBAT hibernacula that affected the thermal regime of caves and, thus, the ability to support hibernating IBATs, as summarized in the draft revised Recovery Plan (USFWS 2007). Generally, threats to the integrity of hibernacula decreased since the listing of IBAT under the ESA. Increasing awareness of the importance of cave microclimates to hibernating bats and regulatory authorities under the ESA helped reduce, but not eliminate, this threat. In addition to purposeful modifications, there are threats from stochastic events (e.g., collapse in mines, flooding).

Loss/Degradation of Forested Habitat

Loss of Forest cover and degradation of forested habitats contributed to the decline of IBAT (USFWS 1983, Garner and Gardner 1992, Drobney and Clawson 1995, Whitaker and Brack 2002). Throughout the IBAT range, there is less forest land now than prior to European settlement (Smith et al. 2003), particularly within the species' core range in the Midwest. Conversion to agriculture is the largest single cause of forest loss. The conversion of floodplain and bottomland forests, recognized as high quality habitats for IBAT, has been a particular cause of concern (Humphrey 1978). More recently, since the 1950s, abandonment of some marginal farmlands helped revert these lands back to forest resulting in a net increase in Forest land within the IBAT range, particularly in the Northeast (Smith et al. 2003). Forest cover increased within the Midwest Recovery Unit (Smith et al. 2003). Not only has the amount of forest cover increased since the 1950s, but also the average diameter of trees increased (Smith et al. 2003), which may equate to an increased supply of suitable roost trees for IBAT.

Urbanization and development is currently the greatest contributor to forested habitat loss within the IBAT range (Wear and Greis 2002; USFS 2005, 2006). At a study site in central Indiana, IBATs avoided foraging in a high-density residential area (Sparks et al. 2005), although maternity roosts occur in some low-density residential areas (Belwood 2002). Duchamp (2006) found greater amounts of urban land use was negatively related to bat species diversity in north-central Indiana. Several bat species, including the IBAT, were less likely to occur in landscapes with greater amounts of urban and suburban development.

Forest cover is not a completely reliable predictor of where IBAT maternity colonies occur on the landscape (Farmer et al. 2002). Indiana bat maternity colonies occupy habitats ranging from completely forested to areas of highly fragmented forest. Nonetheless, trends in forest cover are of interest relative to IBAT, with increasing forest cover suggesting at least the potential for improved habitat conditions.

Throughout the IBAT range, forest conversion is expected to increase due to commercial and urban development, energy production and transmission, and natural changes. The 2010 Resources Planning Act Assessment projects forest losses of 6.5-13.8 million hectares (16–34

million acres) (or 4–8% of 2007 forest area) across the conterminous United States, and Forest loss is expected to be concentrated in the southern United States, with losses of 3.6-8.5 million hectares (9–21 million acres) (USFS 2012). Forest conversion causes loss of potential habitat, fragmentation of remaining habitat, and if occupied at the time of the conversion, direct injury or mortality to individuals.

Disturbance of Hibernating Bats

The original recovery plan stated that human disturbance of hibernating IBATs was one of the primary threats (USFWS 1983). The primary forms of human disturbance to hibernating bats result from cave commercialization (cave tours and other commercial uses of caves), recreational caving, vandalism, and research-related activities. There has been progress in reducing disturbance at caves with hibernating IBATs, but the threat still occurs.

White-nose Syndrome

WNS is an infectious wildlife disease caused by a fungus of European origin, *Pseudogymnoascus destructans* (Pd), and poses a considerable threat to hibernating bat species throughout North America, including the IBAT. White-nose syndrome is responsible for unprecedented mortality of insectivorous bats in eastern North America (Blehert et al. 2009; Turner et al. 2011). No other threat is as severe and immediate for the IBAT as WNS. Since the disease was first observed in New York in 2007 (later biologists found evidence from 2006 photographs), WNS has spread rapidly in bat populations from the East to Midwest and South.

WNS may affect behavioral changes in infected individuals. For example, at some WNS-affected sites, researchers observed a shift of hibernating bats from traditional winter roosts to roosts unusually close to hibernacula entrances. They also observed bats flying outside of hibernacula during winter (often during the day) at some affected sites. At some sites, they found bat carcasses (particularly of the LBBA) outside affected hibernacula. Many infected bats do not survive the winter. The exact processes by which the fungal skin infection leads to death are unknown, but depleted fat reserves (i.e., starvation) contribute to mortality (Reeder et al. 2012, Warnecke et al. 2012) and dehydration may also have a role (Willis et al. 2011, Cryan et al. 2013b, Ehlman et al. 2013). It is also suspected that some affected bats that survive hibernation emerge in such poor condition they soon die. Among those bats that do survive, it appears that productivity of female survivors declines (Francl et al. 2012; Pettit and O’Keefe 2017).

The Northeast Recovery Unit, where WNS was first observed in the winter of 2006-2007, lost over 70% of its IBATs between 2007 and 2015. Based on subsequent observations as WNS spread, it appears that the arrival of the fungus in an area may precede large-scale fatality of bats by several years. Between 2011 and 2015 the Appalachian Recovery Unit, where WNS was confirmed in the winter of 2008-2009, declined by 84%. The Midwest Recovery Unit, where WNS was confirmed in the winter of 2010-2011, declined by 16% between 2011 and 2015. The Ozark-Central Recovery Unit, where WNS was confirmed in the winter of 2011-2012, declined by less than 1% between 2013 and 2015. As of 2016, WNS was confirmed in all the states within the species’ range. We expect further declines in IBAT populations from the disease in the future. Additional information on WNS, which is constantly evolving, can be found online at <http://whitenosesyndrome.org/>.

Environmental Contaminants

Restrictions on the use of organochlorine pesticides in the 1970s reduced this significant threat to IBAT. However, cholinesterase-inhibiting insecticides, organophosphates, and carbamates have now become the most widely used insecticides (Grue et al. 1997), and the effects of these chemicals on IBAT is unknown. Because of the unique physiology of bats in relation to reproduction, high energy demands and sophisticated thermoregulatory abilities, much more research needs to be done with these pesticides and their effects on bats. These and other contaminants likely remain a significant and poorly understood threat to IBAT. USFWS (2007) summarizes known and suspected contaminant threats to bats.

Climate Change

The capacity of climate change to result in changes in the range and distribution of wildlife species is recognized, but detailed assessments of how climate change may affect specific species, including the IBAT, are limited. During winter, only a small proportion of caves provide the right conditions for hibernating IBATs. Surface temperature is directly related to cave temperature, so climate change that involves increased surface temperatures will inevitably affect the suitability of hibernacula. Impacts on the availability or timing of emergence of insect prey are also likely. Loeb and Winters (2013) forecasted significant changes in IBAT summer maternity range within the United States due to climate change.

Wind Turbines

There is growing concern that IBAT (and other bat species) may be threatened by the recent surge in construction and operation of wind turbines across the species' range. Eight IBAT mortalities occurred at wind turbines; five of those were during the fall migration period (USFWS 2014). Not all facilities conduct fatality monitoring and, even with monitoring, the proportion of dead bats found is low. Based on this information, it is likely that additional IBAT mortality occurred at these facilities and at other wind facilities throughout the range of the species.

Recovery

The Service published a recovery plan that outlines recovery actions (USFWS 1983). The draft revised recovery plan (USFWS 2007) focuses on four broad components: 1) range-wide population monitoring at hibernacula with improvements in census techniques, 2) conservation and management of habitat (hibernacula, swarming, and to a degree, summer), 3) further research into requirements of and threats to the species, and 4) public education and outreach.

The Service's Bloomington, Indiana Field Office completed a 5-Year Review of the IBAT (USFWS 2019), which summarizes the current species status, its progress toward recovery, and threats. In this report, the Service concluded that the IBAT should remain listed as 'endangered' because the species status has not improved since listing and new and old threats have not been sufficiently ameliorated. For instance, WNS has significantly and rapidly raised the degree of threat against the IBAT by causing reductions in its fitness, reproductive success and survival, which has lowered the species' overall recovery potential.

4.2. Status of Northern Long-eared Bat

This section summarizes best available data about the biology and condition of the NLEB throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list the NLEB as endangered on November 29, 2022 (87 FR 73488).

4.2.1. Species Description

The NLEB is a temperate, insectivorous, migratory bat that hibernates in mines and caves in the winter and spends summers in wooded areas. The key stages in its annual cycle are: hibernation, spring staging and migration, pregnancy, lactation, volancy/weaning, fall migration and swarming. Northern long-eared bats generally hibernate between mid-fall through mid-spring each year. Spring migration period likely runs from mid-March to mid-May each year. Females depart shortly after emerging from hibernation and are pregnant when they reach their summer area. Young are born between mid-May and early July, with nursing continuing until weaning, which is shortly after young become volant in mid- to late-July (Sasse et al. 2014). Fall migration likely occurs between mid-August and mid-October.

4.2.2. Life History

Northern long-eared bats roost in cavities, underneath bark, crevices, or hollows of both live and dead trees and/or snags (typically ≥ 3 inches DBH). Northern long-eared bats are known to use a wide variety of roost types, using tree species based on presence of cavities or crevices or presence of peeling bark. Northern long-eared bats have also been occasionally found roosting in structures like barns and sheds (particularly when suitable tree roosts are unavailable). Roosting areas utilized by this species average 66.8 ha with a maximum of 186.3 ha (Carter and Feldhamer 2005, Henderson and Broders 2008, Johnson et al. 2012, Silvis et al. 2015). Young NLEBs are typically born in mid-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-June and mid-July. Mist netting in Arkansas from 1996-2013 resulted in captures of pregnant females from May 3 – June 24, lactating females from May 19 – July 30, and the first capture of volant juveniles occurred from June 6 – July 20 (Sasse et al. 2014).

Males and non-reproductive females may summer near hibernacula or migrate to summer habitat some distance from their hibernaculum. Though little is known of this aspect of its life history, the NLEB is not considered to be a long-distance migrant. Small groups of pregnant NLEB have been observed during multiple spring migration periods in a mine in the Ouachitas, but it is not known whether this represents typical roosting ecology in that season (Sasse et al. 2014).

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.

Suitable summer habitat for NLEBs 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, and 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.

Northern long-eared bats tend to roost singly or in small groups (USFWS 2014), with hibernating population sizes ranging from just a few individuals to around 1,000 (USFWS unpublished data). In Arkansas, there are only ten caves where > 10 NLEB have been observed during winter surveys and only two with more than 100 (Sasse et al. 2014). Northern long-eared bats 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). Northern long-eared bats have shown a high degree of philopatry to the hibernacula used, returning to the same hibernacula annually.

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. Most bats of both sexes hibernate by the end of November.

Suitable winter habitat (hibernacula) includes underground caves and cave-like structures (e.g. abandoned or active mines, railroad tunnels). There may be other landscape features being used by NLEBs during the winter that have yet to be documented. Generally, NLEBs hibernate from October to April depending on local weather conditions (November-December to March in southern areas). These bats have been captured in mist nets in Arkansas as early as March 17th and specimens have been submitted for rabies testing as early as March 11th (Sasse et al. 2014). Hibernacula for NLEBs typically have significant cracks and crevices for roosting; relatively constant, cool temperatures 32-48° F (0-9° C) 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.

After hibernation ends in March or early April, most NLEB migrate to summer roosts. Females emerge from hibernation before 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.

4.2.3. Numbers, Reproduction, and Distribution

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; 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 the Canadian Provinces of 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).

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 NLEB) include: Alabama (2), Arkansas (71), 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 269), Nebraska (2), New Hampshire (11), New Jersey (7), New York (90), North Carolina (22), Oklahoma (16), Ohio (7), Pennsylvania (112), South Carolina (2), South Dakota (21), Tennessee (58), Vermont (16), Virginia (8), West Virginia (104), and Wisconsin (67). Northern long-eared bats 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 NLEBs must be described and understood within the context of the impacts of WNS. Before the onset of WNS, the best available information on NLEBs came primarily from surveys (primarily focused on IBAT or other bat species) and some targeted research projects. In these efforts, the NLEB was very frequently encountered and was considered the most common *myotis* bat in many areas. Overall, the species was considered to be widespread and plentiful throughout its historic range (Caceres and Barclay 2000).

4.2.4. Conservation Needs and Threats

Destruction/Degradation of Hibernacula

The NLEB require hibernation sites with specific microclimates and NLEB exhibit high interannual fidelity to their hibernacula. Therefore, like IBAT, threats associated with the complete loss of or modification of winter roosts, can result in impacts to individuals or at the population level.

Loss/Degradation of Forested Habitat

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).

Disturbance of Hibernating Bats

Disturbance within hibernacula can render a site unsuitable or can pose harm to individuals using the site. For example, human entry to hibernating bats can result in additional arousals from hibernation which require an increase in total energy expenditure at a time when food and water resources are scarce or unavailable. There are many conservation efforts and protections (e.g., bat-friendly gates, closure of caves during hibernation) in place that attempt to reduce the risk of modifications to hibernacula and disturbance to overwintering bats.

White-nose Syndrome

No other threat is as severe and immediate for the NLEB as the disease white-nose syndrome (WNS). Although IBAT 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% in the 18 Northeast, which along with Canada, has been considered the core of the species' range. WNS related declines in IBAT populations are estimated at up to 75%, 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 NLEB.

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 NLEBs 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 period following spring emergence.

In areas where WNS is present, there are additional energetic demands for NLEBs. For example, WNS-affected bats have fewer 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).

Climate Change

Climate change variables, such as changes in temperature and precipitation, may influence NLEB resource needs, such as suitable roosting habitat for all seasons, foraging habitat, and prey availability. Although there may be some benefit to NLEB from a changing climate, overall negative impacts are anticipated, especially at local levels.

Wind Turbines

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.

4.3. Status of Tricolored Bat

This section summarizes best available data about the biology and condition of the TRBA throughout its range that are relevant to formulating an opinion about the Action. A petition to list the TRBA as threatened was received by the Service on June 16, 2016. On December 20, 2017, the Service found that the petition presented substantial scientific or commercial information indicating that the petitioned actions may be warranted and commenced a review (as a 12-month finding) to determine if listing of the TRBA is warranted (82 C.F.R. 60362; December 20, 2017). On September 14, 2022, the Service posted a completed Species Status Assessment (SSA) Report for the TRBA (USFWS 2021) and published a proposed rule to list the TRBA as endangered. The proposed rule noted that WNS has caused estimated declines of more than 90% in affected TRBA colonies and is currently present across 59% of the species' range.

4.3.1. Species Description

Tricolored bat is one of the smallest bats in eastern North America and is distinguished by its unique tricolored fur that appears dark at the base, lighter in the middle, and dark at the tip (Barbour and Davis 1969, p. 115). The TRBA often appear yellowish (varying from pale yellow to nearly orange), but may also appear silvery-gray, chocolate brown, or black (Barbour and Davis 1969, p. 115). Males and females are colored alike, but females are consistently heavier than males (LaVal and LaVal 1980, p. 44). Newly volant young are much darker and grayer than adults (Allen 1921, p. 55). Other distinguishing characteristics include 34 teeth (compared with 38 teeth in eastern North American *Myotis* spp. for which it is sometimes confused), a calcar (i.e., spur of cartilage arising from the inner side of the ankle) with no keel, and only the anterior third of the uropatagium (i.e., the membrane that stretches between the legs) is furred (Barbour and Davis 1969, p. 115; Hamilton and Whitaker 1979, p. 85).

4.3.2. Life History

Tricolored bats are known to hibernate in caves, mines, and rock crevices during the winter months (Harvey et al. 1999). In areas where caves are sparse, TRBAs hibernate in road-associated culverts (Sandel et al. 2001, Katzenmeyer 2016, Limon et al. 2018, Bernard et al. 2019, Lutsch 2019, Meierhofer et al. 2019), abandoned water wells (Sasse et al. 2011), and sometimes tree cavities (Newman 2020). In Missouri and Pennsylvania, TRBAs are one of the

first cave-hibernating species to enter hibernation in the fall and one of the last to leave in the spring (LaVal and LaVal 1980, Merritt 1987). However, in the southern U.S., hibernation length is shorter compared to northern portions of the species' range, with some individuals exhibiting shorter torpor bouts and remaining active and feeding during the winter (Layne 1992, Grider et al. 2016, Limon et al. 2018, Newman 2020, Stevens et al. 2020).

Tricolored bats are observed in more caves and mines than any other cave-hibernating bat species in eastern North America (Sealander and Young 1955, Barbour and Davis 1969, Brack et al. 2003). Tricolored bats are observed in small caves and mines that are unsuitable to other cave-hibernating bat species; although, generally in small numbers (Barbour and Davis 1969, Mumford and Whitaker 1982, Hamilton and Whitaker 1979). During hibernation, TRBAs most commonly roost singly, but sometimes in pairs or small clusters of both sexes (Hall 1962, Barbour and Davis 1969, Mumford and Whitaker 1982, Raesly and Gates 1987, Briggler and Prather 2003, Vincent and Whitaker 2007). Tricolored bats are most commonly observed roosting on cave walls and ceilings and rarely are found in crevices (Mumford and Whitaker 1982). Compared to other cave-hibernating species, TRBAs are generally found at the warmest locations within hibernacula with a mean temperature of 10.9 °C (51.6 °F; Barbour and Davis 1969, Raesly and Gates 1987). Tricolored bats prefer high-humidity roosts ranging from 99 to 80% within hibernacula (Mohr 1976, Ploskey and Sealander 1979).

Tricolored bats disperse from winter hibernacula to summer roosting habitat in the spring. Fraser et al. (2012) concluded that at least some TRBAs engage in latitudinal migration that is more typically associated with tree-roosting bats (e.g., hoary bats [*Lasiurus cinereus*], eastern red bats [*Lasiurus borealis*], and silver-haired bats [*Lasionycteris noctivagans*]). The maximum migration distance for a female TRBA was a straight-line distance of 243 km (151 mi) from her winter hibernaculum to summer roost (Samoray et al. 2019). Other migration records between winter hibernacula and summer habitat include less than 80 km (50 mi; Barbour and Davis 1969), 44 km (27 mi; Samoray et al. 2019), and 137 km (85 mi; Griffin 1940). Additionally, the maximum recorded hibernaculum to hibernaculum movement between two consecutive winters is 209 km (130 mi; Lutsch 2019).

Tricolored bat reproduction occurs during fall swarming following migration from summer habitat and prior to entering hibernation. Swarming occurs at cave and mine entrances between mid-August and mid-October. Females store sperm in their uterus during the winter, and fertilization occurs after spring emergence from hibernation (Guthrie 1933). Mating likely does not occur in females entering their first hibernation (i.e., subadults; Fujita and Kunz 1984).

Summer habitat for TRBAs includes suitable food, water, and roost resources. Tricolored bats are a forest-dwelling species and can be found in a variety of predominantly deciduous forest vegetation communities throughout their summer range. At the landscape scale, they are more abundant in highly forested landscapes with adequate connectivity and are less abundant in open areas such as predominantly urban and agricultural landscapes (Duchamp and Swihart 2009, Farrow and Broders 2011).

Tricolored bats primarily roost in live and dead foliage of live or recently dead deciduous trees (Veilleux et al. 2003, Perry and Thill 2007, Thames 2020). Tricolored bats exhibit high site

fidelity to summer roosting habitat (Veilleux et al. 2003). Males roost singly and females congregate into maternity colonies to reproduce communally (Perry and Thill 2007, Poissant et al. 2010).

Tricolored bat maternity colonies are small compared to other cooperative breeding bat species. The largest colony on record consisted of 19 adult females and 37 pups in Massachusetts (Hoying and Kunz 1998). Females give birth between May and July, and typically have two pups (Harvey et al. 2011). Maternity colonies consist of multiple roosts near one another, and females change roosts frequently. In Indiana, females changed roosts between 1.2 - 7 days (Veilleux and Veilleux 2004). Males will roost in forested habitat occupied by maternity colonies, but males are solitary (Veilleux and Veilleux 2004, Perry and Thill 2007, Poissant et al. 2010).

4.3.3. Numbers, Reproduction, and Distribution

Tricolored bats are known from 39 States (from New Mexico north to Wyoming and all states to the east), Washington D.C., 4 Canadian Provinces (Ontario, Quebec, New Brunswick, Nova Scotia), and Guatemala, Honduras, Belize, Nicaragua, and Mexico. The species current distribution in New Mexico, Colorado, Wyoming, South Dakota, and Texas is the result of westward range expansion in recent decades (Geluso et al. 2005; Adams et al. 2018; Hanttula and Valdez 2021) as well as into the Great Lakes basin (Kurta et al. 2007; Slider and Kurta 2011). This expansion is largely attributed to increases in trees along rivers and increases in suitable winter roosting sites, such as abandoned mines and other human-made structures (Benedict et al. 2000; Geluso et al. 2005; Slider and Kurta 2011).

Prior to the onset of WNS, TRBAs were highly abundant and widespread throughout their range. The Service estimates that there were over 140,000 bats observed during hibernacula surveys of 1,951 wintering sites. Tricolored bat occurrence varied spatially and temporally; however, overall abundance on the landscape was stable (Cheng et al. 2021, Wiens et al. 2021).

Available evidence from both winter and summer data, indicates that TRBA abundance has and will continue to decline substantially over the next 10 years under current conditions. Range-wide winter abundance has declined by 52%, and the number of extant winter colonies by 29% since 2000. There has also been a noticeable shift towards smaller winter colony sizes. The magnitude of winter declines, although widespread, varies spatially. The largest decline has been in the northeastern U.S. (89%), where WNS was first discovered, followed by northern states and Canadian provinces (57% decline). The southern portion of the range has seen only a 24% decline.

Summer occurrence and abundance data also show a declining trend for TRBAs. Irvine and Stratton (2021) found that range-wide occupancy declined by 28% from 2010-2019. Similarly, Whitby et al. (2021) analyzed range-wide mobile acoustic data and found a 53% decline from data collected between 2009-2019. Finally, Deeley and Ford (2021) observed a significant decline in mean capture rates from 1999 to 2019 across the TRBAs range.

4.3.4. Conservation Needs and Threats

White-nose Syndrome

WNS is the primary threat influencing TRBA populations. Since the discovery of the fungal pathogen *Pd* in New York in 2007, WNS has spread rapidly and is now predicted present at 85–100% of documented TRBA hibernacula. WNS alters physiological and behavioral processes, often causing direct mortality (Reeder et al. 2012, McGuire et al. 2017). Cheng et al. (2021) estimated that TRBA populations have declined 90–100% across 59% of their range from 1995–2018 resulting from WNS. *Pd* has also been detected in culverts where TRBA colonies hibernate in the southern U.S.; however, WNS-induced mortality has not been documented in these hibernacula (Cross 2019). While state and federal agencies and non-profit conservation organizations have allocated millions in funding to better understand and reduce WNS, impacts from the disease on TRBAs are expected to continue.

Wind Turbines

Wind related mortality is another threat influencing TRBA populations and often overshadowed by WNS. Bat fatality rates vary across facilities, between seasons, and among species. Numerous TRBA fatalities have been documented and based on an October 2020 installed capacity of 104,628 MW (Hoen et al. 2018, USFWS 2021-3546), it is estimated that 3,227 TRBAs are killed annually at wind facilities (Udell et al. 2022). Wind power is a rapidly growing portion of North America's renewable energy portfolio, providing 10.2% of U.S. energy in 2021 (American Wind Energy Association (AWEA) 2021). It is expected that wind facilities will continue to be threat influencing TRBA populations; however, the Service is actively working with wind energy operators to avoid, minimize, and mitigate incidental take of bats (USFWS 2021).

Climate Change

There is growing concern about impacts to bat populations in response to climate change (Jones et al. 2009, Jones and Rebelo 2013, O'Shea et al. 2016). The entire range of the TRBA will be affected by climate change. However, the magnitude, direction, and seasonality of climate changes is not consistent range-wide. It is not expected that every RPU will respond in the same way to similar changes across the range, which makes predicting how climate change will influence TRBA populations challenging to describe. There may be some benefit to TRBA; however, overall negative impacts are anticipated (USFWS 2021).

Habitat Loss and Disturbance

Although a lesser threat compared to WNS and wind energy related fatalities, habitat loss is also recognized as a potential threat to TRBA. Habitat loss can occur during the active season (spring, summer, and fall) as well as during hibernation. During the active season, tree-clearing and forest and/or wetland conversion are associated with losses in suitable roosting or foraging habitat, longer flight distances between roosting and foraging habitats, fragmentation of maternity colonies, and direct injury or mortality. The impacts of habitat loss on TRBA vary based on the timing, location, and extent of habitat removal and the overall landscape composition. For example, removal of forested habitat in an agriculturally dominated landscape will likely have a larger adverse impact on local TRBA populations than the same amount of habitat removal in a heavily forested landscape (USFWS 2021).

Habitat loss and disturbance can also occur during hibernation. Examples of this threat are modification of hibernacula entrances, which may alter hibernacula microclimates and potentially result in direct mortality. Disturbance caused by human activity during hibernation may result in more frequent arousals when food and water resources are scarce. Due to WNS, reducing human disturbance during hibernation is critical, because more frequent arousals from torpor increases the probability of mortality in bats (Boyles and Willis 2010). Currently, there are multiple conservation efforts to help minimize the threat of habitat loss and disturbance during hibernation, including bat-friendly gates, seasonal cave closures, and conservation easements.

5. ENVIRONMENTAL BASELINE

This section describes the best available data about the condition of the IBAT, NLEB, and TRBA in the Action Area without the consequences caused by the proposed Action.

Over the past few decades, there have been bat surveys conducted on the Forest. Surveys have varied from summer use (mist netting and acoustics data) to hibernacula counts (typically internal surveys) and have been conducted by a variety of biologists including those from the Southern Research Station of the Forest Service, District and Forest-level biologists, and section 10 permit holders contracted by the Forest, AGFC, or another agency. Available data from these efforts are provided below for each species. Currently, data are being collected on the Forest to find new caves/mines, assess bat use of new caves/mines, as well as summer use (mist netting and acoustics) data collection.

5.1. Environmental Baseline for Indiana Bat

5.1.1. Action Area Numbers, Reproduction, and Distribution

The Forest is located near the south-western edge of the range of IBAT, which extends from several Midwestern states to the mid-Appalachian Mountains. In Arkansas, there are currently estimated to be just under 5,000 IBATs that hibernate in a limited number of caves scattered through the northern and western part of the state (Figure 5-1). Oklahoma is at the westernmost range of this species and until recently, this species had only been known (on the Forest) to occur on the Oklahoma Ranger District – Choctaw Unit at Bear Den Cave, a winter hibernaculum. Winter surveys in Bear Den Cave have ranged from 0 – 25 IBATs (Figure 5-2). Overall, the data suggests that there are typically less than 10 IBATs in Bear Den Cave in any given year. Although, there may be more that are not easily observable in this system, which could explain the increased count in 2010 of 25 individuals.

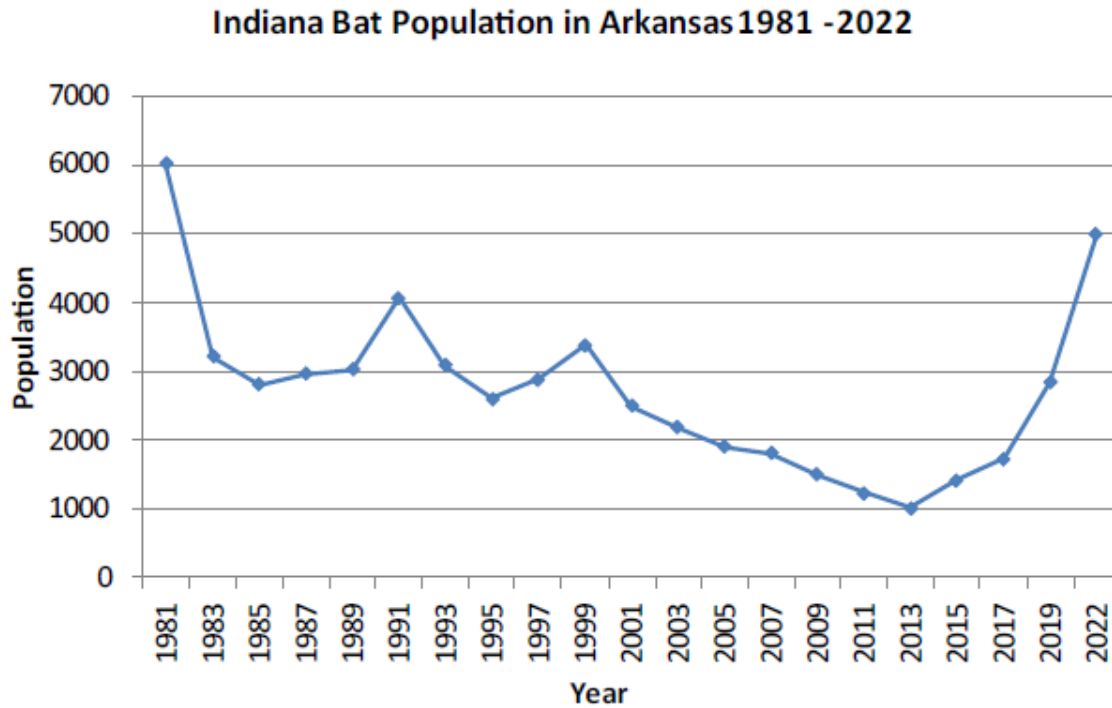


Figure 5-1. Indiana bat population estimate in Arkansas based on winter cave counts (Sasse, 2022).

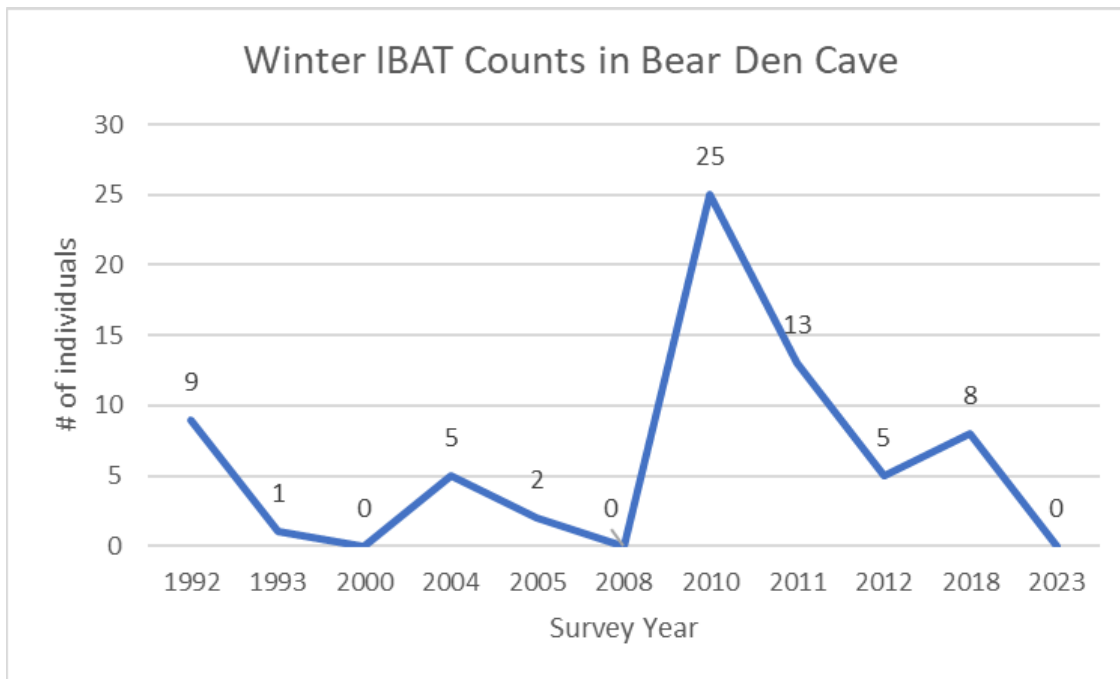


Figure 5-2. Winter survey data for IBAT in Bear Den Cave, Oklahoma from 1992 to 2023. Note: The 2023 survey was conducted in early March and may not accurately reflect a typical hibernacula count.

Although they hibernate together, male and female IBATs in Arkansas have different active season patterns. Males and non-reproductive females are believed to stay closer to the hibernacula or travel only limited distances to active season foraging habitats, whereas females have been found to migrate, in some cases long-distances, to summer maternity habitat (USFWS 2007, Roby 2019, Custer, 2022). To date, no IBAT has been captured via mist netting on the Forest. Although mist netting efforts have occurred on the Forest over the years, most have been either random or focused on one area of the Forest, such as Winona.

Recent work has been conducted to improve our understanding of the migratory patterns of female IBATs that hibernate in caves in the Ozark Plateau in Arkansas (Roby *et al.*, 2021 and Custer 2022). Female bats have been tracked from hibernation caves from Newton and Stone counties in northern Arkansas, some of which occur on the Ozark-St. Francis National Forest to better understand the migration patterns and find the summer maternity colony sites. Females have been found to use short-term roost trees in the area around the caves, typically within 5 miles of the hibernacula for spring staging prior to their migration. Once migration begins, the bats will use stop over roost trees, including at locations on the Forest, for one or more nights on their migration (Roby *et al.*, 2021). Female bats were tracked migrating north into Missouri, south, into southern Arkansas and southern Oklahoma, and east, to bottomland hardwood forests in the Black River area, where a maternity colony was documented (Custer, 2021).

On March 23, 2021, a female IBAT (Bat 120) was hand captured from its hibernacula and released with a radio transmitter for aerial tracking. From its cave location in Newton County, AR, Bat 120 proceeded south approximately 187.3 miles (301.5 km) to Columbia County in southern Arkansas, to her presumed summer roost on April 13, 2021. Bat 120 utilized 7 roost trees during her journey (2 during migration, 3 for layover and 2 at arrival to summer roost). She stayed at one roost just north of the Forest for 9 nights due to low temperatures on the Nimrod Lloyd Millwood Wildlife Management Area (WMA) in Yell County only 602 feet and 1,225 feet from the Forest boundary. She foraged on the Forest near Hogan Creek on the Jessierville/Winona/Fourche (JWF) District. Bat 120 preferred dead shortleaf pine with good bark cover (7 of 8 roosts). The only other roost of her journey was a dead pin oak snag with good exfoliating bark cover (Copperhead Environmental Consulting, 2021b).

In the same spring emergence tracking project, another female (Bat 300) flew to Yell County on April 7 and 8, 2021, before moving on to the Tiak Unit of the Forest in McCurtain County, Oklahoma. Unfortunately, the roost tree in Yell County was not located, however it was determined that Bat 300 roosted on the JWF as well (Roby *et al.*, 2021). Four roost trees were located for Bat 300 on the Tiak and were identified as shortleaf pine snags, though one was probably mis-identified as a longleaf pine. Survey efforts such as emergence counts, radio-tracking, mist netting, acoustic monitoring, and guano collection were employed to find the presumed maternity colony. This effort resulted in one positive guano sample from one of the trees in July of 2021 (Northern Arizona University Report 2021). Additionally, 16 acoustic monitoring sites (164 nights) were surveyed resulting in 3 IBAT calls detected. Mist netting was also conducted on eleven sites (61 net nights), however no IBATs were captured (Copperhead Environmental Consulting, 2021a).

5.1.2. Action Area Conservation Needs and Threats

Indiana bat populations have been declining since the early 1960s. The declining numbers were observed at winter hibernacula sites, such as caves and abandoned mines, where the bats gather in large numbers. On the Forest, the primary threats to IBATs include WNS and potential human disturbance to the hibernaculum. Additionally, individual bats are at risk of being killed, injured, or harassed by falling occupied roost trees or activities that may disturb a roosting bat and cause it to fly during the day. Bats utilizing the Forest might also be at risk from wind energy facilities located within the migratory routes of the covered species. Although there are no completed wind farms in Arkansas to date, there are a couple proposed for the state. There is one wind farm in southeast Oklahoma (Pushmataha Co.) within relatively close proximity (~15 miles) to the Forest boundary. Although, neither of these farms are within the Action Area. In-cave disturbance is another factor and is regularly addressed (e.g., cave gates, signs, etc.) for known caves in the Action Area. Habitat conversion does happen, although most tree removal occurring in the Action Area is occurring in the form of habitat modification or management. The Forest Plan and conservation measures in the BA contain measures specific to habitat management for bats. Timing restrictions on tree falling activities around the hibernacula reduce the risk of injury and harassment to individuals during the critical fall swarming and spring emergence periods. Habitat management, such as pond creation and maintenance, tree cutting and prescribed fire for forest health and habitat diversity, and watershed and riparian zones management are key to the survival of this species.

The Forest will conduct surveys for new populations and improve and maintain favorable habitat conditions for IBAT. The Forest intends to monitor and protect areas of use, as described in the BA, based on past and ongoing surveys, such as mist netting, harp trapping, radio telemetry, acoustic monitoring, and hibernacula surveys.

5.2. Environmental Baseline for Northern Long-eared Bat

5.2.1. Action Area Numbers, Reproduction, and Distribution

Northern long-eared bat was a common and relatively abundant forest bat species throughout its range in Arkansas prior to the arrival of WNS. Range-wide, observed declines include a significant reduction in winter colonies (-81%) and summer occupancy (-80%) (USFWS, 2022). Perry and Jordan (2022) documented a 98% decline of NLEB in the Winona District of the Forest post WNS. A total of 293 NLEBs have been captured via mist netting from 2000 to 2020 (Forest data). During this same time, 180 of those individuals were captured from fixed sites with the highest capture success year being 2005 with 64 captures. In Bear Den Cave (Oklahoma Ranger District – Choctaw Unit), NLEBs have been regularly observed during winter counts (Figure 5-3) and fall trapping (Figure 5-4) efforts occurring at the cave entrance. Forest biologists collected as many as 463 NLEBs during one fall trapping event in 2004 (Figure 5-4). In contrast, the highest number of NLEBs observed during the winter surveys in the same cave was 96, with multiple years only observing NLEBs in the single digits (Figure 5-3). There are a couple of possible explanations for the notable differences in abundance from the winter and fall survey efforts. First, NLEBs are notorious for hibernating in cracks and crevices in caves, which can make finding them very difficult during winter surveys. It's possible that there were many

more individuals present during the winter surveys and biologists just couldn't see them. Second, not all bats hibernate in the same cave where they exhibit fall swarming behavior. If this is the case for NLEBs at Bear Den Cave, then there is likely another (or more than one) hibernacula within proximity that these bats are overwintering in. Additionally, it's worth noting that 36 NLEBs were also captured at the entrance of Bear Den Cave on July 11, 1984, by Forest biologists (unpublished Forest data). This indicates that NLEBs may be utilizing this cave year-round during any given year.

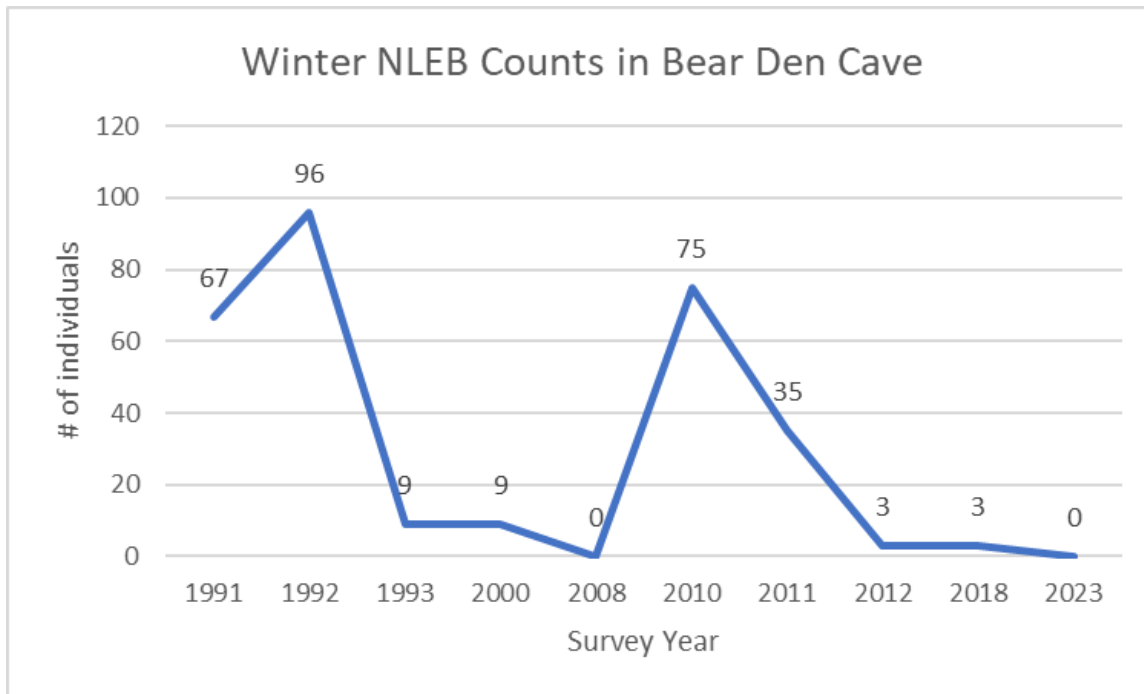


Figure 5-3 Winter survey data for NLEB in Bear Den Cave, Oklahoma from 1991 to 2023. Note: The 2023 survey was conducted in early March and may not accurately reflect a typical hibernacula count.

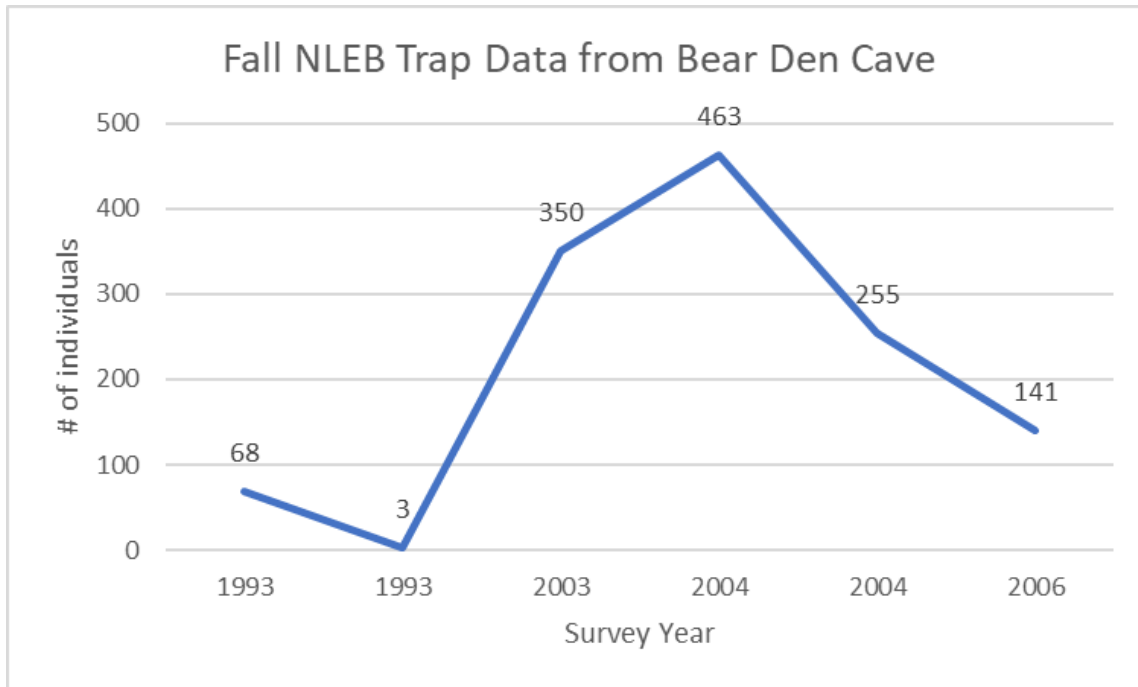


Figure 5-4 Fall survey data for NLEB collected at the entrance of Bear Den Cave, Oklahoma from 1993 to 2006. These efforts were conducted sometime between mid-August to the end of September in any given year.

The AGFC hired a contractor to mist net and perform acoustic monitoring on 30 sites on the Forest in 2022. Twenty-eight were completed in Montgomery, Garland, Polk, Scott with 3 nets per site, during August. No NLEBs were captured during these surveys. In Oklahoma, mist netting occurred at 11 sites (61 net nights) during summer 2021. A juvenile female NLEB was captured and tracked to two roost trees in bottomland hardwood habitat on the Tiak Unit in McCurtain County (Copperhead Environmental Consulting, 2021a). However, no NLEB were detected in the guano trapping efforts (Northern Arizona University, 2021) or from any acoustic monitoring of 16 sites (164 acoustic nights) during the same period, (Bat Conservation International, 2022). There are around 80 known NLEB records in Oklahoma (unpublished OFO data), including three records in McCurtain County, with the 2021 data making it four.

Northern long-eared bats utilize a variety of forest stand types for foraging and roosting, and there is mixed evidence in the literature about the specific forest habitat types preferred by the species. Based on years of surveys of NLEB on the Forest, the species forages across a wide range of forest types, frequently along low-use roads, trails, or small streams in forested stands. Based on the foraging habitat types used by NLEB and the historic abundance of the species on the Forest, suitable foraging habitat is available in abundance on the Forest.

Studies on the roosting habits of NLEB indicated that the species can use a wide range of sizes and species of trees for roosting (Silvis et. al., 2015). However, a recent study on the Ozark St. Francis National Forest found that female NLEB on the Mt. Magazine Ranger District selected mostly oak or hickory trees as maternity roosts, and those were most commonly dead trees (88%) with cavities (Edmonds, 2020). Several roost trees including maternity trees were identified during that study.

5.2.2. Action Area Conservation Needs and Threats

The factors affecting NLEB in the Action Area are a subset of the threats affecting the species' range-wide and include WNS, wind energy development, disturbance, and habitat conversion. White-nose Syndrome was first detected in Arkansas in the winter of 2011 – 2012 and apparently has caused a 99% decline in summer captures of this species in the Ozarks (Edmonds 2020). Perry and Jordan (2022) documented a 98% decline of NLEB in the Winona District of the Forest post WNS. Although there are no completed wind farms in Arkansas to date, there are a couple proposed for the state. Also, neither of these farms are within the Action Area. However, individuals hibernating or summering on the Forest could interact with proposed wind farms when migrating in the spring or fall. In-cave disturbance is another factor and is regularly addressed (e.g., cave gates, signs, etc.) for known caves in the Action Area. Habitat conversion does happen, although most tree removal occurring in the Action Area is occurring in the form of habitat modification or management. The Forest Plan contains measures specific to habitat management for bats.

5.3. Environmental Baseline for Tricolored Bat

5.3.1. Action Area Numbers, Reproduction, and Distribution

Tricolored bats occupy every district on the Forest during the active season and are widespread in the caves and mines occurring on the Forest in the winter. A total of 2,047 TRBA have been observed via internal winter counts from 16 known locations prior to 2015, which is approximately when WNS began to have observable effects to TRBA populations. From 2015 to 2021, internal counts have yielded only 613 TRBA from 15 known locations. Bat sampling efforts conducted from 2000-2022, yielded 101 TRBA captures, with 26% of those being captured in 2005 (unpublished Forest data). In Bear Den Cave (Oklahoma Ranger District – Choctaw Unit), TRBAs have been regularly observed during winter counts (Figure 5-5) and fall trapping (Figure 5-6) efforts occurring at the cave entrance. Forest biologists collected as many as 150 TRBAs during one fall trapping event in 2004 (Figure 5-6). Internal winter surveys yielded over 300 TRBAs in the same cave over multiple years (2008, 2010, and 2011) and only began to see single digit numbers after the arrival of WNS (Figure 5-5). Unlike NLEB, TRBA can often be found roosting in visible areas of caves (i.e., not hidden in crevices), so winter counts of this species would be arguably more representative of what's there, than for NLEB. Additionally, it's worth noting that 48 TRBAs were also captured at the entrance of Bear Den Cave on July 11, 1984, by Forest biologists (unpublished Forest data). This indicates that TRBAs may be utilizing this cave year-round during any given year.

In 2022, AGFC hired a contractor to mist net and perform acoustic monitoring on 30 sites in 2022. Twenty-eight were completed in Montgomery, Garland, Polk, Scott with 3 nets per site, during August. No TRBA were captured during these surveys.

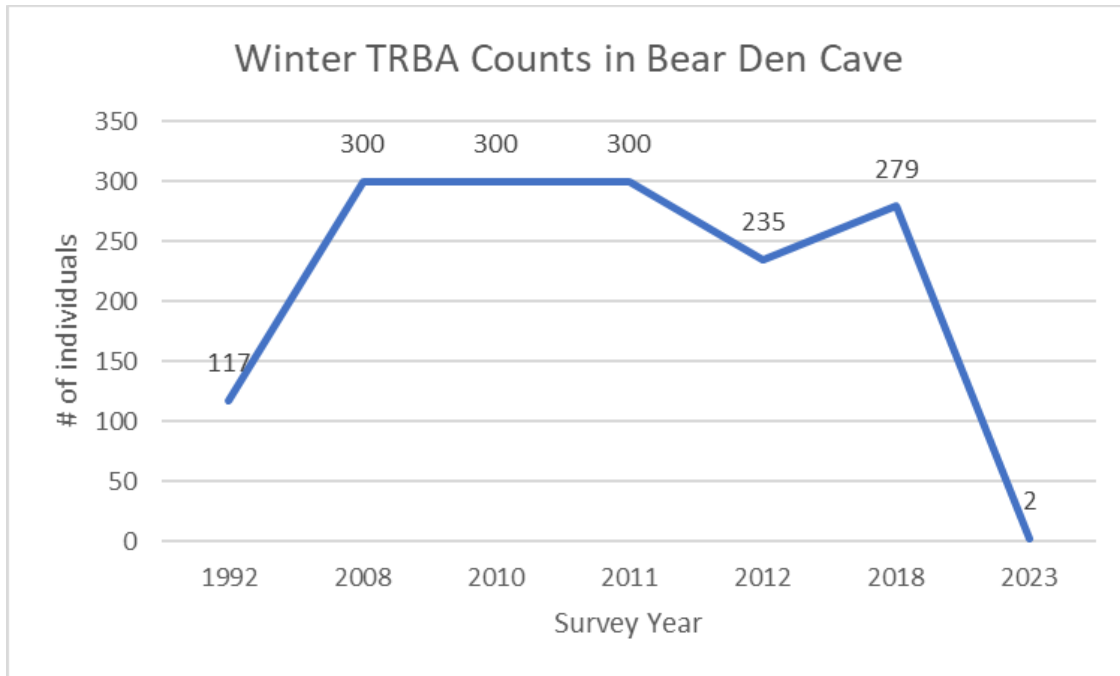


Figure 5-5. Winter survey data for TRBA data in Bear Den Cave, Oklahoma from 1992 to 2023. Note: The surveys conducted in 2008, 2010, and 2011 all noted an abundance of greater than 300 individuals. Also, the 2023 survey was conducted in early March and may not accurately reflect a typical hibernacula count.

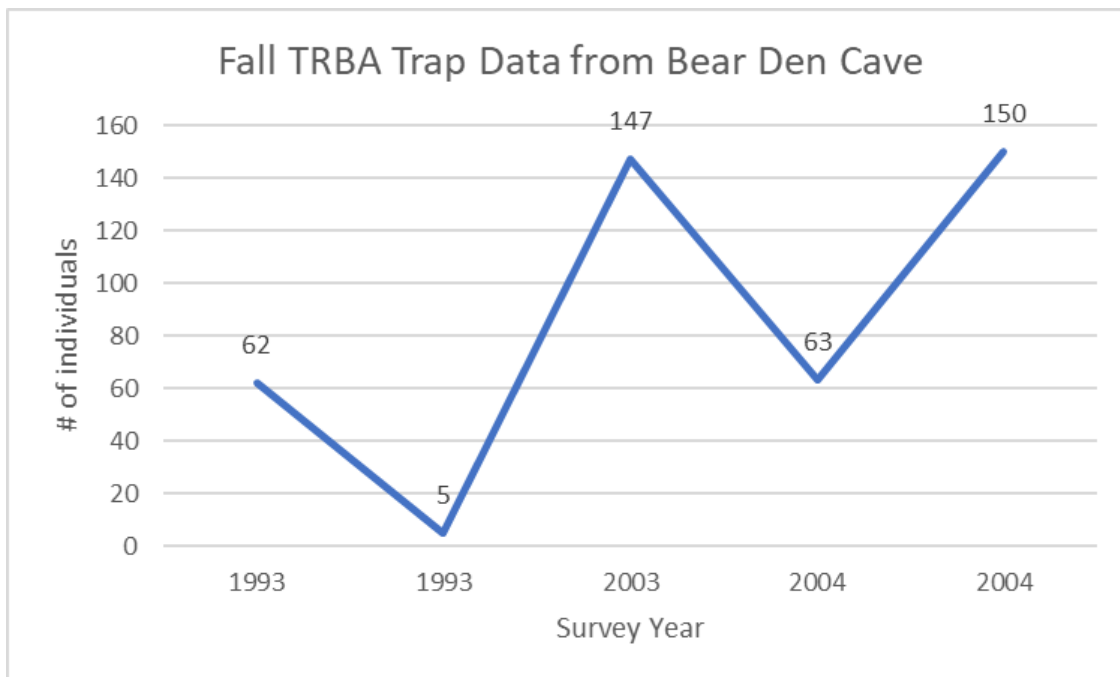


Figure 5-6 Fall survey data for TRBA collected at the entrance of Bear Den Cave, Oklahoma from 1993 to 2004. These efforts were conducted sometime between mid-August to the end of September in any given year.

As with NLEB, the species has declined substantially and WNS is the primary influence of those declines. From 2010-2019, range wide winter abundance declined by 52% and summer occupancy declined by 28% (U.S. Fish and Wildlife Service, 2021). Winter survey data in Arkansas indicates a decline in abundance of approximately 90% (Figure 5-7).

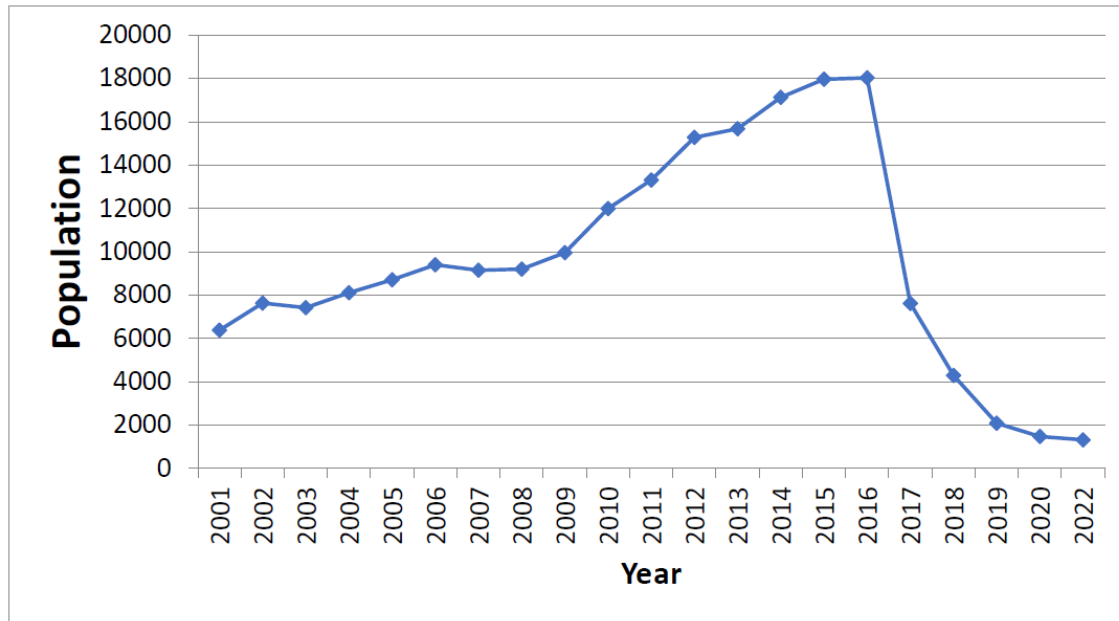


Figure 5-7. Tricolored bat population estimates for Arkansas based on winter counts (Sasse 2022).

5.3.2. Action Area Conservation Needs and Threats

The factors affecting TRBA in the Action Area are a subset of the threats affecting the species’ range-wide and include WNS, wind energy development, disturbance, and habitat conversion. Winter survey data in Arkansas indicates that the declines in abundance in the state have been closer to 90%. Although there are no completed wind farms in Arkansas to date, there are a couple proposed for the state. Also, neither of these farms are within the Action Area. However, individuals hibernating or summering on the Forest could interact with proposed wind farms when migrating in the spring or fall. In-cave disturbance is another factor and is regularly addressed (e.g., cave gates, signs, etc.) for known caves of *Myotis* species in the Action Area. However, the Action Area occurs in an area considerably more inundated with mines than caves due to the geology of the area. Caves/mines with large numbers of TRBA are being considered for greater protective measures. However, the Service is still assessing what affect in-cave disturbance has had on this species. Habitat conversion does happen, although most tree removal occurring in the Action Area is occurring in the form of habitat modification or management. The Forest Plan contains measures specific to habitat management for bats.

6. EFFECTS OF THE ACTION

In a BO for a listed species, the effects of the proposed action are all reasonably certain consequences to the species caused by the action, including the consequences of other activities

caused by the action. Activities caused by the action would not occur but for the action. Consequences to species may occur later in time and may occur outside the action area.

We identified and described the activities included in the proposed Action in sections 2.1–2.10. To adequately evaluate the effects of the action, the proposed Forest Plan activities are broken down into two sub-activities that could result in adverse effects to the species: (1) tree removal and (2) prescribed burning. Based on the Proposed Action, species biology and relevant literature, the Service identified stressor(s) (i.e., the alteration of the environment that is relevant to the species) that may result from the Action. Below, we discuss the best available science relevant to each likely effect on IBAT, NLEB, and TRBA collectively. Then, we describe the Stressor-Exposure-Response (SER) pathways that identify the circumstances for an individual bat's exposure to the stressor (i.e., the overlap in time and space between the stressor and a bat). Finally, we identify and consider how proposed conservation measures may reduce the severity of the stressor or probability of an individual bat's exposure for each pathway.

Tree Removal and Prescribed Burning

The Service expects tree removal (suitable habitat) ($\leq 94,049$ acres and 1,100 individual trees annually) and prescribed burning (up to 250,710 acres annually) practices to occur in IBAT, NLEB, and TRBA habitat anywhere within the 1.8 million acres of forested habitat available for Forest Plan implementation on the Forest.

Tree removal will occur during timber harvest (i.e., regeneration harvest, thinning, clearcuts, salvage/sanitation, and firewood collection), road and trail projects (i.e., construction, reconstruction, maintenance, and decommissioning), and non-timber harvest clearing (i.e., wildlife opening creation and maintenance, mulching, reforestation site prep, glade restoration, minerals development, pond construction/reconstruction, stream and lake large woody debris, recreation site maintenance, forest site clearing, wildlife stand improvement, range allotment management, and ROW maintenance), as well as some fire lane development and hazard tree removal during prescribed burning. The Service expects tree removal to result in the following stressors: noise/vibration, loss of roosts, forest loss/fragmentation, and loss of prey base. The Service expects prescribed burning to result in the following stressors: noise, loss of roosts, loss of prey base, and heat/smoke. We evaluate the applicable science and SER pathways for tree removal and prescribed burning below.

6.1.1. Stressor: Noise/Vibration (Tree Removal and Prescribed Burning)

The people, chainsaws, and heavy equipment involved in forest management activities as described above generate noise and/or vibrations that could disturb IBAT, NLEB, and TRBA. During the active season, this disturbance could cause volant bats to temporarily flee or permanently abandon roosts during the day. Refer to Effects Pathway 1 for conservation measures to avoid and minimize effects to IBAT, NLEB, and TRBA.

Applicable Science

Bats may be disturbed while roosting by noises of activities on the Forest created by Forest staff, contractors, or the public. Noise disturbance comes from vehicle traffic on Forest or other connected roads, heavy equipment involved in timber, non-commercial silviculture treatments,

or construction projects. Smaller equipment can create noise disturbance such as mowers, leaf blowers, toilet pumpers, chainsaws, and similar equipment.

Bats may be less likely to roost in areas of the forest near high use roads due to the regular sound disturbances (Bennett and Zurcher, 2013). These species of bats may be disturbed while roosting near a project activity area by heavy equipment sounds or vibrations due to construction work or timber harvest such as engine sounds, track noise, back-up warnings, or activities such as excavation, tree falling, blading, dumping rock, demolition, or pile driving. Noise disturbance could also occur due to chainsaws, mowers, or other small equipment. Bats have been shown to come partially out of torpor when stimulated by noise and that bats habituate to predictable noise levels (Luo et al., 2014). A bat that is roosting near this type of activity may rouse and leave the roost during the day, which could have a cost in energy reserves, a stress response, and an increased risk of predation due to daytime flight. Noise and activity may help provide a warning to bats in the area of forest site clearing or another activity area, which might cause the bat to leave a roost prior to that tree being fallen.

Gardner et al. (1991) found that IBAT continues to roost and forage in areas with active timber harvest. This suggested that noise and exhaust emissions from machinery could possibly disturb colonies of roosting bats, but such disturbances would have to be severe to cause roost abandonment. Callahan (1993) noted the likely cause of the bats in his study area abandoning a primary roost tree was disturbance from a bulldozer clearing brush adjacent to the tree. In another study near I-70 and the Indianapolis Airport, a primary maternity roost was located 1,970 ft. (0.6 km) south of I-70 (3D/International, Inc. 1996). This primary maternity roost was not abandoned despite constant noise from the Interstate and airport runways. However, the roost's proximity to I-70 may be related to a general lack of suitable roosting habitat in the vicinity, and the bats had become habituated to the noise from the airport (USFWS 2002).

Mikula et al. (2016) reviewed approximately 1,500 reports from 109 countries of attacks by 143 species of diurnal birds on 124 species of bats. The family *Vespertilionidae*, to which the genus *Myotis* belongs, represented 22.8 and 58.8 percent of cases of bats taken by raptors of the hawk and falcon families, respectively, and 77 percent of bats taken by non-raptors (e.g., gulls, crows). Citing data from other studies, the authors surmised that the diurnal predation rate on bats is likely 100–1,000 times higher than the nocturnal predation rate when standardized relative to the duration of day versus night bat activity. Therefore, forest management activities causing daytime disturbances that may flush bats from roosts could increase predation threats.

Effects Pathway 1

Activity: Tree removal and prescribed burning	
Stressor: Noise/vibration	
<i>Exposure (time)</i>	March 2 – November 15; annually; specific duration will vary
<i>Exposure (space)</i>	~344,759 acres of forested habitat on Forest annually
<i>Resource affected</i>	Individuals (juveniles, adults)
<i>Individual response</i>	Extra energy expenditure; decreased fitness; mortality
<i>Effect</i>	Direct and indirect harm
<i>Conservation Measures</i>	The Forest proposes to implement multiple conservation measures in addition to existing measures for bat protection and management in the

Effects Pathway 1

Activity: Tree removal and prescribed burning

Stressor: Noise/vibration

	Forest Plan. Prescribed burn strategies near moderate to high-use hibernacula, hibernacula buffers for noise disturbance, AFO/OFO coordination on activities occurring within roost zones, seasonal tree cutting restrictions, protection and buffering of known roost trees, and snag retention are examples of measures being proposed to avoid or minimize the effect of noise/vibration on the covered species. For a complete list of conservation measures, see Section 2.11. For a complete list of existing bat related Forest Plan measures, see Appendix A.
<i>Interpretation</i>	Bats may become startled by the noise and flush from their roosts during tree removal or prescribed burning actions that could occur March 2 – November 15 when bats are present on the landscape. Bats that flush during the daytime are at greater risk of harm due to predation. We expect the Forest to mitigate potential adverse effects resulting from flushing females in a roost tree with pups upon implementation of the Forest Plan conservation measures.

6.1.2. Stressor: Loss of Roosts

All forest management activities proposed by the Forest that include tree removal and prescribed fire could remove suitable roost trees. Refer to Section 2.11 and Appendix A for a complete list of measures to avoid or minimize direct effects to IBAT, NLEB, and TRBA.

6.1.2.1. Loss of Occupied Roosts

Applicable Science

Tree Removal: Risk of injury or death from being crushed when a tree is felled is most likely to affect non-volant pups and occasionally adults (Belwood 2002). This risk is greater for adults during cooler weather when bats periodically enter torpor and cannot arouse quickly to respond (i.e., flush, and potentially avoid being in the roost when it is felled). Indiana bat is also at an increased predation risk when flushed during daylight hours due to the felling of an occupied roost, or disturbance associated with habitat removal adjacent to an occupied roost (Mikula et al. 2016).

Trees fallen during the pup season (June 1 to July 31) could potentially have nursing young bats that have not yet developed the ability to fly. Indiana and LBBAs often have larger maternity colonies in a single tree with 50 or more mother and pup pairs not uncommon. Tricolored bats have been reported to have solitary or small summer maternity colony roosts primarily in vegetation clusters (Perry and Thill, 2007; Veilleux *et al.*, 2003). Although the mothers can carry the young, pups are at greater risk of injury or death if a tree that they are roosting in is fallen compared to a bat that can fly. If a mother can leave the roost before or while it is being fallen, they would still be exposed to additional predation risk and would need to find another suitable roost tree.

We are aware of three accounts of occupied IBAT roost trees being felled. In all cases, it was not known that the tree contained a bat roost, and, in all cases, some bats in the tree were killed or injured. Cope et al. (1974) reported on the first known IBAT maternity roost tree, a dead elm in Wayne County, Indiana. The original account stated that eight bats were “captured and identified as IBATs,” and that about 50 bats flew from the tree. Although, the original account did not specify how the eight bats were captured, J. Whitaker (Indiana State University, pers. comm., 2005, as cited in the draft revised IBAT recovery plan) recounted that those bats were killed or disabled, retrieved by the landowner, and subsequently identified by a biologist.

In another case, Belwood (2002) reported on the felling of a dead maple in a residential lawn in Ohio. One dead adult female and 33 non-volant young were retrieved by the researcher. Three young bats were already dead when they were picked up, and two more died subsequently. The rest were apparently retrieved by surviving adult bats. In a third case, 11 dead adult female IBATs were retrieved (by people) when their roost was felled in Knox County, Indiana (J. Whitaker, pers. comm., 2005, as cited in the draft revised IBAT recovery plan).

Prescribed Burning: Fire use is generally advocated as a way of improving bat habitat, through snag production, creation of more open stands preferred for foraging, and increased insect abundance and diversity (e.g., USFWS 2007a). Fires both create and destroy snags, with unknown long-term effects in eastern hardwood forests (Dickinson et al. 2009). Roost characteristics, such as height above ground, snag condition, and landscape position, also influence risk from fire. Fires not only create snags by killing trees, some of which may be live roosts, but also fell snags through the structural weakening caused by smoldering combustion (Carter et al. 2002). Burning may create more suitable snags for roosting through exfoliation of bark (Johnson et al. 2009), mimicking trees in the appropriate decay stage for roosting bats. Perry (2012) suggests that depending on fire severity, seasonality, and frequency, evidence from the east suggests that fire can often recruit more trees or snags into conditions suitable for day-roosts for bark- and cavity-dwelling bat species than are lost.

Effects Pathway 2

Activity: Tree removal	
Stressor: Loss of occupied roost trees	
<i>Exposure (time)</i>	March 2 – November 15; annually; specific duration will vary
<i>Exposure (space)</i>	~94,049 acres of forested habitat and ~1,100 individual trees on Forest annually
<i>Resource affected</i>	Individuals (juveniles, adults), habitat (roost trees)
<i>Individual response</i>	Injury/mortality; flushing from the roost tree; predation; energy expenditure; decreased fitness
<i>Effect</i>	Direct and indirect harm

Effects Pathway 2

Activity: Tree removal

Stressor: Loss of occupied roost trees

<i>Conservation Measures</i>	The Forest proposes to implement multiple conservation measures in addition to existing measures for bat protection and management in the Forest Plan. AFO/OFO coordination on activities occurring within roost zones, seasonal tree cutting restrictions, protection and buffering of known roost trees, and snag retention are examples of measures being proposed to avoid or minimize the effect of tree removal and potential loss of occupied trees on the covered species. For a complete list of conservation measures, see Section 2.11. For a complete list of existing bat related Forest Plan measures, see Appendix A.
<i>Interpretation</i>	Bats that remain in felled trees may be struck or crushed. Bats that flush from the tree will be exposed to increased levels of predation. Bats that survive may experience reduced fitness due to the additional energy expenditure associated with finding a new, suitable roost tree. The implementation of the Forest Plan conservation measures will minimize adverse effects to non-volant pups and pregnant or lactating females.

Effects Pathway 3

Activity: Prescribed Burning

Stressor: Loss of occupied roost trees

<i>Exposure (time)</i>	March 2 – November 15; annually; specific duration will vary
<i>Exposure (space)</i>	~250,710 acres of forested habitat on Forest annually
<i>Resource affected</i>	Individuals (juveniles, adults), habitat (roost trees)
<i>Individual response</i>	Flushing from the roost tree; predation
<i>Effect</i>	Direct and indirect harm
<i>Conservation Measures</i>	The Forest proposes to implement multiple conservation measures in addition to existing measures for bat protection and management in the Forest Plan. Prescribed burn strategies near moderate to high-use hibernacula, AFO/OFO coordination on activities occurring within roost zones, seasonal tree cutting restrictions, protection and buffering of known roost trees, and snag retention are examples of measures being proposed to avoid or minimize the effect of prescribed burning and potential loss of occupied roost trees on the covered species. For a complete list of conservation measures, see Section 2.11. For a complete list of existing bat related Forest Plan measures, see Appendix A.
<i>Interpretation</i>	Fire may consume roost trees and snags, causing bats to flush. Bats will be more susceptible to predation and could experience reduced fitness due to the additional energy expenditure associated with fleeing the burning area and finding a new suitable roost tree. The implementation of the Forest Plan conservation measures will minimize adverse effects to

Effects Pathway 3

Activity: Prescribed Burning

Stressor: Loss of occupied roost trees

	non-volant pups and pregnant or lactating females while in occupied roost trees.
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6.1.2.2. Loss of Unoccupied Roosts

Applicable Science

Indiana bats form summer maternity colonies that exhibit “fission-fusion” behavior (Barclay and Kurta 2007; Garroway and Broders 2007). Members coalesce to form a group (fusion), but the composition of the main unit is dynamic. Individuals exit the main unit for solitary roosting or to form smaller roosting groups (fission), and later return to the main unit, which may sometimes move to another roost. Indiana bat switches roosts often, typically every 2–3 days (Kurta et al. 2002; Kurta 2005; Foster and Kurta 1999; Owen et al. 2002; Carter and Feldhamer 2005; Timpone et al. 2010). Female TRBA form maternity colonies and switch roost trees regularly (e.g., between 1.2 days and 7 days at roost trees in Indiana) (Veilleux and Veilleux 2004a, p. 197; Quinn and Broders 2007, p. 19; Poissant et al. 2010, p. 374). Males roost singly (Perry and Thill 2007, p. 977; Poissant et al. 2010, p. 374). Because these species will rely on previously established roosts, roost tree loss, regardless of whether it occurs during the active or inactive (winter) seasons, may affect the fission-fusion dynamics of maternity colonies that can lead to a reduction in individual fitness as a result of increased energy expenditure.

These effects are compounded in the action area because most of the returning bats are coming from hibernacula infected with white-nose syndrome (WNS). Individuals surviving WNS have additional energetic demands. For example, WNS-affected bats have fewer fat reserves than non-WNS-affected bats when they emerge from hibernation (Reeder et al. 2012; Warnecke et al. 2012) and have wing damage (Reichard and Kunz 2009, Meteyer et al. 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, maintain a successful pregnancy, rearing pups, and healing their own bodies.

Effects Pathway 4

Activity: Tree removal and prescribed fire

Stressor: Loss of unoccupied roost trees

<i>Exposure (time)</i>	Annually, specific duration will vary
<i>Exposure (space)</i>	~344,759 acres of forested habitat on Forest annually
<i>Resource affected</i>	Individuals (juveniles, adults), habitat (roost trees)
<i>Individual response</i>	Energy expenditure; reduced fitness
<i>Effect</i>	Indirect harm
<i>Conservation Measures</i>	The Forest proposes to implement multiple conservation measures in addition to existing measures for bat protection and management in the

Effects Pathway 4

Activity: Tree removal and prescribed fire

Stressor: Loss of unoccupied roost trees

	Forest Plan. Prescribed burn strategies near moderate to high-use hibernacula, AFO/OFO coordination on activities occurring within roost zones, seasonal tree cutting restrictions, protection and buffering of known roost trees, and snag retention are examples of measures being proposed to avoid or minimize the effect of tree removal and prescribed fire for the potential loss of unoccupied trees on the covered species. For a complete list of conservation measures, see Section 2.11. For a complete list of existing bat related Forest Plan measures, see Appendix A.
<i>Interpretation</i>	Removal and loss of roost trees during the unoccupied timeframe may result in increased energy expenditure due to increased time spent seeking out new roosting habitat that would have otherwise been spent on foraging, pup rearing, social interactions, or other activities. We expect the use of additional energy in response to habitat loss, especially when combined with the energy needs associated with normal life cycle processes (e.g., recovery from WNS effects, pup rearing, etc.) or other stressors to result in delayed reproduction, spontaneous abortion, hypothermia, and starvation in some cases. While some adverse effects resulting from roost tree loss are unavoidable, the Forest will implement conservation measures to create/retain suitable roosting habitat to minimize indirect harm as indicated in Section 2.11 and Appendix A.

6.1.3. Stressor: Forest Loss and Fragmentation

All habitat management that includes tree removal is designed to improve bat habitat in the short- and/or long-term and ensure overall quantity and quality of treated habitat is not degraded by forest management prescriptions.

Applicable Science

In highly fragmented landscapes, loss of connectivity among remaining forest patches may degrade IBAT habitat quality (USFWS 2007). Patterson et al. (2003) noted that the mobility of bats allows them to exploit habitat fragments. However, they cautioned that reliance on already diffuse resources (e.g., roost trees) leaves bats highly vulnerable, and energetics may preclude the use of overly patchy habitats. Racey and Entwistle (2003) discussed the difficulties of categorizing space requirements in bats, as they are highly mobile and show relatively patchy use of habitat (and use of linear landscape features), although connectivity of habitats has some clear advantages (e.g., aid orientation, attract insects, provide shelter from wind and/or predators). Murray and Kurta (2004) demonstrated the importance of wooded travel corridors for IBATs within their maternity habitat in Michigan; they noted that bats did not fly over open fields but traveled along wooded corridors, even though use of these corridors increased commuting distance by > 55 percent. Sparks et al. (2005) also noted the importance of a wooded riparian travel corridor to IBATs in the maternity colony. A study in the Ozarks found that occupancy

increased with percent forest area for long-eared bats but decreased for TRBAs (Starbuck et al., 2015). A study of habitat use of bat species in a savannah to forest gradient found that TRBA occupancy was unrelated to vegetation structure (Starbuck et al., 2015). A study of bat use on the Cumberland Plateau in Tennessee found that TRBAs used stands that were heavily thinned and received prescribed burning treatments at a higher level, despite evidence that prey availability was not higher, indicating that the open forest structure played an important role in foraging quality (Cox et al., 2016).

Carter et al. (2002) noted that IBAT roosts evaluated in their southern Illinois study area were in highly fragmented forests, although both the number of patches and mean patch size of bottomland hardwood forest and closed-canopy deciduous forest were higher in the area surrounding roosts than around randomly selected points (i.e., IBATs were using the least fragmented forest blocks available to them in that landscape). Carter et al. (2002) found mean patch size of bottomland forest for circles (2 km [1.2 m] in diameter) surrounding roosts was 35.9 ha (88.7 acres), compared to 1.5 ha (3.7 acres) around random locations. Mean patch size of closed-canopy deciduous forest was 7.9 ha (19.5 acres) around roosts compared to 3.4 ha (8.4 acres) around random locations. In both cases, the difference was statistically significant. This analysis shows the likelihood of IBATs roosting in a particular forest patch increases with the size and connectivity of that forest patch. In landscapes dominated by agriculture or other non-forested cover types, IBAT may use all or most available forest patches as part of their home range and may stretch their home range beyond 2.5 miles from roosting areas. Kniowski and Gehrt (2014) suggest longer or more frequent commuting flights in highly fragmented landscapes, with smaller, more distant suitable habitat patches, to obtain similar resources compared to landscapes with larger, more abundant habitat patches. In Ohio, radio tagged bats moved the farthest in areas with limited forested cover. Several traveled 5 – 6 miles (8-9.7 km), and one bat flew straight-line distance of about 7 miles but may have flown approximately 10 miles (16.1 km) (K. Lott, USFWS, pers. comm.).

In a fragmented landscape, IBAT may fly across less suitable habitat. This could pose greater risk of predation (e.g., raptors). IBAT consistently follows tree-lined paths rather than crossing large open areas (Gardner et al. 1991, Murray and Kurta 2004). Murray and Kurta (2004) found that IBAT increased its commuting distances by 55 percent to follow these paths rather than flying over large agricultural fields. However, if these corridors are not available, IBAT may be forced over open areas. For example, Kniowski and Gehrt (2014) observed IBAT flying across open expanses of cropland >1 km (0.6 miles) to reach remote, isolated woodlots or riparian corridors.

Although researchers found it difficult to predict where maternity colonies may occur relative to forested habitat, researchers can reliably predict that once IBAT colonizes maternity habitat, they will return to the same maternity areas annually (USFWS 2007). Philopatry of IBAT maternity colonies to their summer range is well documented. Indiana bat likely returns to the same place each year whether there is enough habitat in the immediate vicinity to support a colony or not. Given the additional energy expenditures expected in fragmented landscapes, it is unclear as to the status of colonies at the lower end of the percent forest cover spectrum. Colonies may be smaller in size in areas with reduced forest.

Kurta (2005) noted that impacts on reproductive success of IBAT are a likely consequence of traditional roost site loss. He suggested that reduced reproductive success may be related to stress, poor microclimate in new roosts, a reduced ability to thermoregulate through clustering, or reduced ability to communicate and thus locate quality foraging areas. He further suggested that the magnitude of impacts would vary greatly depending on the scale of roost loss (i.e., how many roosts are lost and how much alternative habitat is left for the bats in the immediate vicinity of the traditional roost sites).

In areas with WNS, there are additional energetic demands for IBAT. For example, WNS-affected bats have fewer fat reserves than non-WNS-affected bats when they emerge from hibernation (Reeder et al. 2012; Warnecke et al. 2012) and have wing damage (Reichard and Kunz 2009, Meteyer et al. 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.

The species covered by the existing consultation have a much higher tolerance for forest fragmentation than what will be experienced under this proposal, and there may be some benefit of increased edge habitat and fragmentation for foraging and travelling. A limited amount of fragmentation may benefit bats by providing more diverse habitat in closer proximity. For example, bats may be able to find sufficient roosting and foraging habitats that are closer together in areas with greater habitat complexity (Ethier and Fahrig, 2011).

Effects Pathway 5

Activity: Tree Removal	
Stressor: Forest loss and fragmentation	
<i>Exposure (time)</i>	Year-round
<i>Exposure (space)</i>	~94,049 acres of forested habitat on Forest annually
<i>Resource affected</i>	Individuals (juveniles, adults), habitat (roost trees)
<i>Individual response</i>	Reduced fitness
<i>Effect</i>	Insignificant
<i>Conservation Measures</i>	The Forest proposes to implement multiple conservation measures in addition to existing measures for bat protection and management in the Forest Plan. AFO/OFO coordination on activities occurring within primary management zones, seasonal tree cutting restrictions, protection and buffering of known roost trees, and snag retention are examples of measures being proposed to avoid or minimize the effect of tree removal pertaining to forest loss and fragmentation on the covered species. For a complete list of conservation measures, see Section 2.11. For a complete list of existing bat related Forest Plan measures, see Appendix A.
<i>Interpretation</i>	A goal of forest management activities within the Action Area is to improve habitats for wildlife species, including bats. Forest will implement conservation measures designed to preserve existing bat habitat and enhance habitat in the long-term for treatments within suitable habitat. Therefore, given the nature of the treatments and implementation of conservation measures, it is unlikely that forested corridors used for commuting or foraging will be fragmented to a degree

that significantly alters the behavior of the covered species. In the long-term, habitat continuity and habitat availability are expected to improve for the species.

6.1.4. Stressor: Heat and Smoke

Applicable Science

Little is known of the direct effects of fire on cavity and bark roosting bats, and few studies have examined escape behaviors, direct mortality, or potential reductions in survival associated with effects of fire. Bat species in the Southeast have evolved in fire-dominated ecosystems and exposure to heat and smoke has likely shaped their roosting strategies.

Roosting location, including roosting height may be part of the roosting strategy to avoid effects of heat and smoke during a forest fire. Although the literature on this issue is limited, there is evidence that smoke can cause arousal from torpor in some bats, although there is limited testing in the species currently under consultation (Scesny and Robbins, 2006, Doty *et al.*, 2018). Bat species studied showed an arousal response from smoke and an indication of an escape response; however, the arousal time has been shown to be related to ambient temperatures, which may affect the ability of the bat to avoid injury due to acute respiratory failure or burn injury (Doty *et al.*, 2018). Dickinson *et al.* (2009) monitored two NLEBs during a controlled summer burn. Both bats exited their roosts within 10 minutes of ignition near their roosts and flew to areas where the fire was not occurring. Among four bats they tracked before and after burning, all switched roosts during the fire, and no mortality was observed. Likewise, Rodrigue *et al.* (2001) reported flushing of a *Myotis* bat from an ignited snag during an April controlled burn in West Virginia.

Fire could have mixed effects on IBAT habitat (e.g. burning a suitable roost tree that kills, weakens the tree, or peels away bark). Perry (2012) found that bats often take advantage of fire-killed snags. Overall, fire may result in both the loss and the production of snags. Fire in any season that results in tree mortality may provide more benefit to IBAT through snag creation than any negative impacts that may occur. In the long term, fire may benefit IBAT habitat by reducing the threat of future severe fires. Removing fuel biomass will decrease the risk of major fire events within a stand, which ensures continued presence of suitable roosts and foraging habitat. In addition, prescribed fire promotes the growth of remaining trees due to decreased competition with other vegetation.

Smoke exposures determined by fire behavior are a realm which the fire manager has substantial control through choice of burning conditions and firing methods (Dickinson *et al.* 2009). Choice of burning weather and season are well-known methods of manipulating fire behavior and, thus, smoke exposures.

Carter *et al.* (2002) suggested that the risk of direct injury and mortality to southeastern forest-dwelling bats resulting from summer prescribed fire is generally low. During warm temperatures, bats can arouse from short-term torpor quickly. Most adult bats are quick, flying at speeds > 30 km/hour (> 18 miles/hour) (Patterson and Hardin 1969), enabling escape to unburned areas. Dickinson *et al.* (2010) used a fire plume model, field measurements, and models of carbon monoxide and heat effects on mammals to explore the risk to tree-roosting bats during prescribed fires in mixed-oak forests of southeastern Ohio and eastern Kentucky. In his

study, carbon monoxide levels did not reach critical thresholds that could harm bats in low-intensity burns at typical roosting heights for the IBATs (8.6 m). However, in this range of heights, direct heat could cause injury to the thin tissue of bat ears. Such injury would occur at roughly the same height as tree foliage necrosis (death), or where temperatures reach 60 °C (140 °F).

Effects Pathway 6

Activity: Prescribed burning	
Stressor: Heat/smoke	
<i>Exposure (time)</i>	March 2 – November 15
<i>Exposure (space)</i>	~250,710 acres of forested habitat on the Forest annually
<i>Resource affected</i>	Individuals (juveniles, adults), habitat (roost trees)
<i>Individual response</i>	Injury or death; flushing from the roost tree; predation
<i>Effect</i>	Direct/indirect harm
<i>Conservation Measures</i>	The Forest proposes to implement multiple conservation measures in addition to existing measures for bat protection and management in the Forest Plan. Prescribed burn strategies near moderate to high-use hibernacula, AFO/OFO coordination on activities occurring within primary management zones, seasonal tree cutting restrictions, protection and buffering of known roost trees are examples of measures being proposed to avoid or minimize the effect of prescribed burning for heat and/or smoke on the covered species. For a complete list of conservation measures, see Section 2.11. For a complete list of existing bat related Forest Plan measures, see Appendix A.
<i>Interpretation</i>	Bats that remain in trees could be injured or killed by heat/smoke. Bats that flush from the tree will be exposed to increased levels of predation and will experience reduced fitness due to the additional energy expenditure associated with fleeing the burning area. The implementation of the Forest Plan conservation measures will minimize adverse effects the covered species due to heat/smoke exposure from prescribed burns.

6.1.5. Stressor: Loss of Prey Base

Applicable Science

The effects of vegetation management on insect prey communities may vary and can be dependent on many factors, including management prescription, ecological type, vegetation condition, as well as a variety of landscape and climatic conditions that may vary both spatially and temporally. The high diversity of insect prey taxa and variation in response to vegetative treatments across differing landscapes and years precludes any broad-scale determination regarding the effect of vegetation management on prey populations. Some studies indicate that while regeneration cuts result in a decrease in the abundance of Lepidopterans, the primary prey for many bat species, the use of selective harvest management practices does not result in significant alteration of these prey (Summerville and Crist 2002, Dodd et al. 2012). However, moth abundance is often related to woody stem density, likely because woody plants are host for

many species of moths. A study on the Forest found that moth abundance was lower in recently commercially thinned forest stands compared to unthinned stands (Tormanen and Garrie, 2021).

Prescribed fire can affect forest insect communities that are the prey for these species of bats. A study on the impact of prescribed fire on moth abundance in the Ozarks found that moths were more abundant in burned stands compared to unburned stands (Guerra et al., 2019). Another study in the Boston Mountains found that stands with high frequency burning had more moths, but sites with intermediate burn frequency had fewer moths than unburned control sites (Tormanen and Garrie, 2021). An investigation of a savannah site managed for 30 years with frequent fire found that some species abundances were affected in the growing season following a burn, but those same species benefitted in the long term from the effects to the habitat conditions promoted by prescribed fire (Sieman et al., 1997).

Ground-disturbing activities, such as timber harvest, heavy construction, road construction or maintenance, prescribed fire, and stream restoration can result in soil erosion and siltation of streams, which could affect aquatic invertebrate communities that are a portion of the prey base for the species included in this consultation. The foraging behavior of these species is somewhat different, but they each are known to use waterbodies or streams as foraging areas at times and each species can be opportunistic foragers even if aquatic macro-invertebrates are not the primary prey taxa of any of the species.

Effects Pathway 7

Activity: Tree Removal and Prescribed burning	
Stressor: Loss of Prey Base	
<i>Exposure (time)</i>	March 2 – November 15
<i>Exposure (space)</i>	~344,759 acres of forested habitat on Forest annually
<i>Resource affected</i>	Individuals (juveniles, adults)
<i>Individual response</i>	Reduced fitness
<i>Effect</i>	Direct/indirect harm
<i>Conservation Measures</i>	The Forest proposes to implement multiple conservation measures in addition to existing measures for bat protection and management in the Forest Plan. Prescribed burn strategies near moderate to high-use hibernacula, AFO/OFO coordination on activities occurring within primary management zones, seasonal tree cutting restrictions, protection and buffering of known roost trees, and snag retention are examples of measures being proposed to avoid or minimize the effect of tree removal and prescribed fire on the prey base of the covered species. For a complete list of conservation measures, see Section 2.11. For a complete list of existing bat related Forest Plan measures, see Appendix A.
<i>Interpretation</i>	Bats that emerge from hibernation and migrate through or summer on the Forest may encounter recent or active management areas on the Forest. There may be short term affects to bats prey base during these instances that may reduce the fitness of individuals due to the additional energy expenditure associated with searching other areas for prey. However, the long-term effects of the habitat management and

Effects Pathway 7

Activity: Tree Removal and Prescribed burning

Stressor: Loss of Prey Base

implementation of the conservation measures in Section 2.11 and Appendix A, are expected to benefit the prey base for the covered species.

6.1.6. Summary of Effects

The stressors associated with each activity is summarized in Table 6-1.

Table 6-1. Summary of Stressors on the covered bat species.

Proposed Activities	Stressors				
	Noise/Vibration	Loss of Roosts	Heat/Smoke	Forest Loss Fragmentation	Loss of Prey Base
Prescribed Burning	x	x	x		x
Tree Removal	x	x		x	x

6.2. Cumulative Effects

In section 3, we did not identify any activities that satisfy the regulatory criteria for sources of cumulative effects. Therefore, cumulative effects to IBAT, NLEB, and TRBA are not relevant to formulating our opinion for the Action.

6.3. Conclusion

In this section, we summarize and interpret the findings of the previous sections (status, baseline, effects, and cumulative effects) relative to the purpose of the BO for the IBAT, NLEB, and TRBA, which is to determine whether the Action is likely to jeopardize its continued existence.

Tree removal (suitable habitat) (≤94,049 acres and 1,100 individual trees annually) and prescribed burning (up to 250,710 acres annually) practices are proposed to occur in IBAT, NLEB, and TRBA habitat over the next 10 years and could occur anywhere within the 1.8 million acres of forested habitat available for Forest Plan implementation on the Forest. To date, IBAT, NLEB, and TRBA hibernacula and summer use, as well as some migratory behavior has been documented on the Forest. Additionally, ongoing mist netting and acoustic data collection efforts may yield additional information in the coming years.

We anticipate that activities listed in Section 2.1 – 2.10 conducted during the active season will result in adverse effects to IBAT, NLEB, and TRBA in summer (including possible unknown

maternity), swarming and staging, and migratory/stop-over habitat on the Forest. Effects to individuals from the above listed activities are likely to occur any time during the active season and to any cohort of individuals present during proposed activities. Potential effects to bats in the absence of conservation measures range in intensity and severity from high to low depending on where, when, and over what size an area the activities occur. Considering actions that occur only in the active season, effects are greatest if activities occur during the summer, especially during the non-volant pup season, in known occupied areas, and over many acres. Effects are lowest if activities occur during the migratory season, away from known bat occurrences, and include a small number of acres. Implementation of the conservation measures described in Sections 2.11 and Appendix A will avoid and minimize the highest potential effects by protecting known active season use areas through establishment of special management buffers and seasonal cutting and burning restrictions. Potential effects that are of low to moderate severity and intensity still could occur during the active season despite the conservation measures. Accordingly, our analysis indicates the proposed action is not likely to cause population-level (e.g., maternity colony or hibernacula) effects that would lead to a decrease in fitness and viability of a population unit.

After reviewing the status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's BO that the Action is not likely to jeopardize the continued existence of the IBAT, NLEB, or TRBA.

7. INCIDENTAL TAKE STATEMENT

ESA §9(a)(1) and regulations issued under §4(d) prohibit the take of endangered and threatened fish and wildlife species without special exemption. The term "take" in the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (ESA §3(19)). In regulations, the Service further defines:

- "harm" as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering;" (50 CFR §17.3) and
- "incidental take" as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant" (50 CFR §402.02).

Under the terms of ESA §7(b)(4) and §7(o)(2), taking that is incidental to a Federal agency action that would not violate ESA §7(a)(2) is not considered prohibited, provided that such taking follows the terms and conditions of an incidental take statement (ITS).

For the exemption in ESA §7(o)(2) to apply to the Action considered in this BO, the Forest must undertake the non-discretionary measures described in this ITS, and these measures must become binding conditions of any permit, contract, or grant issued for implementing the Action. The Forest has a continuing duty to regulate the activity covered by this ITS. The protective coverage of §7(o)(2) may lapse if the Forest fails to:

- assume and implement the terms and conditions; or
- require a permittee, contractor, or grantee to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit, contract, or grant document.

To monitor the impact of incidental take, the Forest must report the progress of the Action and its impact on the species to the Service as specified in this ITS.

7.1. Amount or Extent of Take

This section specifies the amount or extent of take of listed wildlife species that the Action is reasonably certain to cause, which we estimated in the “Effects of the Action” sections of this BO.

Based on the results of the Effects of the Action analysis above, the Service anticipates that incidental take of IBAT, NLEB, and TRBA in the form of harm and kill is likely to occur because of the proposed action. Despite implementation of Forest conservation measures, we anticipate that some male, female, and juvenile IBAT, NLEB, and TRBA may be killed or injured while conducting forest management activities under the Forest Plan, as amended. This is likely to occur if an occupied roost tree is felled during summer roosting, migration, staging, or swarming. We anticipate that proposed Forest management activities (e.g., timber harvest, prescribed burning, road and trail work, and non-timber tree removal) will result in take in the form of harm of individuals up to 344,759 acres (annually) of suitable summer roosting, swarming, staging, and migratory habitats. Take will be measured by the number of acres of suitable roosting habitat that are modified or removed during implementation of the amendment to the Forest Plan covered in this BO. Direct take also will be detected by observing disturbance, injury, or mortality of individuals or colonies.

The Forest must reinitiate consultation with the Service if more than 344,759 acres of suitable habitat are modified or removed annually by actions covered in this BO through January 17, 2035, or until a new revised Forest Plan is signed and implemented, whichever comes first.

Surrogate Measures for Monitoring

For the IBAT, NLEB, and TRBA, detecting take that occurs incidental to the Action is not practical. When it is not practical to monitor take in terms of individuals of the listed species, the regulations at 50 CFR §402.14(i)(1)(i) indicate that an ITS may express the amount or extent of take using a surrogate (e.g., a similarly affected species, habitat, or ecological conditions), provided that the Service also:

- describes the causal link between the surrogate and take of the listed species; and
- sets a clear standard for determining when the level of anticipated take has been exceeded.

Indiana bat, NLEB, and TRBA are medium-sized bats weighing only one-quarter of an ounce, and detecting individuals subject to incidental take will be exceptionally difficult. For this reason, it is not practicable to monitor take in terms of individual bats. Strict adherence to the components of the proposed action through field monitoring and regular reporting during the term of the action as set forth in the **Monitoring and Reporting** below constitute a reasonable and practical alternative to ensure that the exempted take levels are not exceeded. The various components of the proposed action establish certainty that IBAT, NLEB, and TRBA are likely to be exposed to Forest management activities, at times, in a manner that conforms to take. In that

way, components of the proposed action are linked to IBAT, NLEB, and TRBA incidental take. The Service believes that acreage of suitable habitat removed, which identifies the level of use associated with the action, is the most practical surrogate for measuring bat take. Therefore, the Service determined that if any actions exceed the acreage totals, this will trigger reinitiation. The Service will determine if the use associated with take is approaching the amount described above through review of annual monitoring reports submitted to the Service by the Forest. Any deviation from the proposed action that increases exposure of IBAT, NLEB, and TRBA to proposed Forest management activities and conservation measures will constitute exceedance of the exempted take level requiring immediate coordination with the Service to determine if reinitiation of formal consultation is warranted.

7.2. Reasonable and Prudent Measures

The Action includes conservation measures to avoid and minimize impacts to IBAT, NLEB, and TRBA, promote recovery by improving bat habitat on Forest, and by maintaining a robust monitoring program. Therefore, the Service believes that no reasonable and prudent measures are necessary or appropriate to minimize the impact, *i.e.*, the amount or extent, of incidental take of the covered species caused by the Action. Minor changes that do not alter the basic design, location, scope, duration, or timing of the Action would not reduce incidental take below the amount or extent anticipated for the Action as proposed. Therefore, this ITS does not provide RPMs for these species.

7.3. Terms and Conditions

No reasonable and prudent measures to minimize the impacts of incidental take caused by the Action are provided in this ITS; therefore, no terms and conditions for carrying out such measures are necessary.

7.4. Monitoring and Reporting Requirements

To monitor the impacts of incidental take, the Forest must report the progress of the Action and its impact on the species to the Service as specified in the ITS (50 CFR §402.14(i)(3)). This section provides the specific instructions for such monitoring and reporting (M&R), including procedures for handling and disposing of any individuals of a species actually killed or injured. These M&R requirements are mandatory.

As necessary and appropriate to fulfill this responsibility, the Forest must require any permittee, contractor, or grantee to accomplish the M&R through enforceable terms that the Forest includes in the permit, contract, or grant document. Such enforceable terms must include a requirement to immediately notify the Forest and the Service if the amount or extent of incidental take specified in this ITS is exceeded during Action implementation.

To ensure the amount or extent of incidental take is not exceeded and activities in the Programmatic BO are carried out as described, Forest will provide an annual report that includes:

1. List of all completed projects in the calendar year that conducted Forest management activities that are considered an adverse effect as described in this BO.
2. Total annual acreage per activity described as follows:
 - Commercial timber harvest (by cutting method)
 - Regeneration harvest
 - Thinning
 - Salvage/Sanitation
 - Firewood collection
 - Temporary road construction and decommissioning
 - Prescribed burning
 - Forest site clearing
 - Non-commercial silvicultural activities
 - Tree release
 - Wildlife or timber stand improvement
 - Mulching
 - Precommercial thinning
3. Active Season (March 2 – November 15) Activities (no reporting required if conducted during the hibernation period)
 - Mastication, limbing, roadside vegetation clearing (acres)
 - Fire line construction and preparation (acres)
 - Individual tree removal – not included in above categories (trees)
4. Summary of the implemented activities.

The report should be received by the AFO/OFO no later than February 1 of each year, unless an extension is mutually agreed upon by the AFO/OFO and Forest.

Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the local federal law enforcement officer located at the Arkansas Ecological Services Field Office at 110 South Amity Road, Suite 300, Conway, Arkansas 72032 (phone 501/513-4482).

8. CONSERVATION RECOMMENDATIONS

§7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to avoid or minimize the adverse effects of a proposed action, implement recovery plans, or develop information that is useful for the conservation of listed species. The Service offers the following recommendations, in addition to those listed in the “Survey and Monitoring Recommendations” listed in the BA, that are relevant to the listed species addressed in this BO and that we believe are consistent with the authorities of the Forest.

1. Install signage at hibernacula informing forest users of cave closures.
2. Gates or fences should be evaluated for any priority hibernation site of the covered species, especially those that pose a risk to the public and sites with prior history of unauthorized and/or frequent entry. Gates or other physical barriers to entry should have a bat-friendly design and post-construction monitoring should be completed to ensure bats are able to successfully ingress and egress.
3. Consider snag creation (e.g., through girdling or stem-injection herbicides) in locations conducive to bat roosting, including in areas with an emphasis on pine-oak-hickory recruitment, in natural or anthropogenic openings near forest edges, along linear edges with solar exposure, and in riparian habitat when natural roosts are in short supply.
4. Continue to implement netting and acoustic data collection on Forest to better understand bat distribution. When searching for summer use, AFO recommends collecting data from May 15 – August 15, although surveys during the spring and fall period may be situationally valuable as well. When feasible, follow up on positive acoustic detections with mist-net surveys by the following summer in areas that have indication of occupancy by IBAT, LBBA, NLEB, or TRBA.

9. REINITIATION NOTICE

Formal consultation for the Action considered in this BO is concluded. Reinitiating consultation is required if the Forest retains discretionary involvement or control over the Action (or is authorized by law) when:

- a. the amount or extent of incidental take is exceeded,
- b. new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO,
- c. the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO, or
- d. a new species is listed, or critical habitat designated that the Action may affect.

In instances where the amount or extent of incidental take is exceeded, the Forest is required to immediately request a reinitiation of formal consultation.

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11. APPENDIX A

Forest Plan Objectives

Objectives

OBJ01. Increase prescribed fire to an average of 180,000 acres per year by 2011 to help achieve and maintain desired community conditions.

OBJ02. Move 5,000 acres into fire regime condition class I annually.

OBJ03. Treat at least 300 acres per year for non-native, invasive species.

OBJ04. Maintain or improve the population status of all species that are federally listed or proposed for listing when evaluated at 5-year intervals.

OBJ05. For wildlife purposes, strive to achieve a total open road density of 1.0 mile per square mile or less for all MAs except MAs 1 and 4 (where the desired density is zero open roads per square mile) and MAs 2, 16, 17, 19, and 21 (where the desired density is 0.75 mile of open road per square mile or less during critical periods for wildlife, i.e., March to August).

OBJ06. Establish 5,500 acres per year in grass/forb condition within the pine-oak forest subsystem while maintaining 60-90 percent in mature to late seral condition.

OBJ07. Increase cumulative total area being restored to shortleaf pine-bluestem grass or shortleaf pine-oak woodland conditions to 350,000 acres by 2021.

OBJ08. Establish and maintain the following mix of seral stages in pine-bluestem woodland: 3-9% early, 15-30% mid, and 60-90% late seral.

OBJ09. Apply management actions to restore ecosystem health in at least 5,000 acres per year of oak forests and woodlands affected by oak decline and other hardwood diseases, insect problems, and drought.

OBJ10. Reduce susceptibility to southern pine or Ips beetle outbreaks on at least 25,000 acres per year.

Proposed, Endangered, Threatened, and Sensitive (PETS) Species Habitat

Desired Condition: Habitats for federally listed species (and those proposed for listing) are conserved or restored, and listed species are recovered. Habitats for sensitive species and other species of concern are sufficient to prevent downward trends in populations or habitat capability and to prevent federal listing. Flow regimes and habitat connectivity in streams that provide habitat for Proposed, Endangered, Threatened, and

Sensitive aquatic and riparian-dependent species are sufficient to allow the affected species to complete all phases of their life cycles. Vegetation conditions reflect the desired conditions identified for each system in the previous section. FP page 20.

Monitoring and Evaluation: Annually report findings of all monitoring and research efforts involving PETS species. At five-year intervals, evaluate trends.

Threatened, Endangered, and Sensitive Species and their Habitats The Endangered Species Act of 1973 requires that all threatened and endangered species and their habitats be protected on federal land. The standards in this section apply Forest-wide to species listed or proposed for listing by the U.S. Fish and Wildlife Service as Threatened or Endangered. Four of the standards also apply to Sensitive species listed by the Regional Forester for the Southern Region of the USDA Forest Service and occurring or thought to occur on the Ouachita National Forest. Sensitive species are listed because of concerns about their long-term viability; they are not listed or proposed for listing by the U.S. Fish and Wildlife Service. The Forest Service Manual (FSM 2600) and standards for the following MAs supply additional guidance for managing habitats of federally listed and sensitive species and protecting their populations: Wilderness (MA 1), Rare Upland Communities (MA 6), Water and Riparian Communities (MA 9), and Renewal of the Shortleaf Pine-Bluestem Grass Ecosystem and Red-cockaded Woodpecker Habitat (MA 22). FP page 76

Indiana Bat Habitat (Bear Den Cave)

Mine and Cave Habitat

TE002 Proposed mining operations affecting abandoned mine adits and shafts or natural dens and caves that could be considered suitable habitat for federally Threatened and Endangered species or Southern Region Sensitive species must include conservation measures to protect the species and habitat.

TE006 Maintain the cave gate to protect hibernating bats. The known hibernaculum and any other hibernacula that may be discovered will be protected by maintaining a buffer having a radius of 2 miles. Within this buffer, proposed ground-disturbing management projects and prescribed burning will be evaluated to determine their direct, indirect, and cumulative effects on Indiana bats and the hibernaculum.

TE007 When planning and conducting prescribed burns inside or near the Bear Den Cave buffer, avoid inundating the cave with smoke.

Sensitive Bat Species

TE009 Before a structural modification is initiated to the roof of a building, bridge, mine, or well, a bat survey will be conducted for sensitive bat species. If evidence of sensitive roosts bats is present; habitat will be protected or an alternate roost will be provided (bat boxes).

Relevant Forest Standards and Guides from Ouachita National Forest Revised Plan

FR001 Maintain pines and hardwoods throughout the life of each stand in which timber harvesting takes place unless project-level concerns dictate a need for change.

FR002 During the regeneration of pine stands, retain large overstory hardwoods distributed throughout the stand at the rate of 5 sq. ft. of basal area per acre where available.

FR003 During the regeneration of pine stands, base the hardwood sprout/seedling component objective (10 to 30 percent of stems in hardwoods, primarily oaks and hickories), on the composition of the stand prior to regeneration cutting.

FR004 In mixed pine-hardwood forests subject to timber harvesting, maintain between 30 and 50 percent hardwood in each stand, including large overstory.

FI004 During the implementation of release, pre-commercial thinning and commercial thinning treatments, retain a diverse hardwood component in hard mast producing species such as oaks and hickories.

FR008 In pine-hardwood mixed management type, desired hardwood species will be managed to accomplish specific project-level objectives. If existing hardwood trees are adequate in size, quality, and spacing, they may be used to support hardwood component goals. Otherwise, regenerate hardwood by coppice.

Follow-up vegetation management treatments may be used to

FR010 Clearcutting may be utilized only in the following instances:

- to rehabilitate stands damaged by storm, insects/disease, fires, or other natural events.
- to rehabilitate newly acquired lands,
- to restore native forests on lands that currently support non-native tree species,
- to aid the recovery of threatened or endangered species

FR011 When using the seedtree method of regeneration cutting, the seed trees will be retained indefinitely.

FR012 When using the shelterwood method of regeneration cutting, a portion of the overwood may be removed if deemed necessary to promote growth and development of reproduction, but a portion of the overwood equivalent to a seedtree basal area will be retained indefinitely.

Fireline Construction

PF005 Minimize fireline construction. Use natural and existing man-made fuel breaks such as streams, rockslides, roads, and trails where available.

PF006 If necessary to cross a stream with a fireline, see standard 9.24.

Wildlife Habitat

VM004 Within managed pine stands, maintain or develop a component of 10 to 30 percent of the total basal area in hardwood trees in dominant or co-dominant crown classes. Favor oaks and hickories in meeting this objective.

WF001 On a project-by-project basis, provide grass-forb or shrub-seedling habitats (include regeneration areas 0-10 years in age, areas of recent heavy storm or insect damage, and woodland conditions) at a rate of:

- a minimum of 6 percent of the suitable acres in MAs 14, 15, 16, 17, and 19 (Ouachita Mountains Habitat Diversity Emphasis, West Gulf Coastal Plain Habitat Diversity Emphasis, Lands around Lakes, Semi-primitive Areas, and Winding Stair Mountain National Recreation Area and Associated Non-Wilderness Designations, respectively)
- a minimum of 3 percent of the suitable acres in MA 21, Old Growth
- a minimum of 4 percent of the suitable acres in MA 22, Shortleaf Pine/Bluestem Grass/RCW

WF002 Limit even-age regeneration cutting in each project area to no more than 14 percent of the suitable acres managed under even-aged prescriptions, per 10-year entry except for the following:

- 6-10 percent in Semi-primitive Areas, MA 17
- 6 percent in Old Growth, MA 21
- 8.3 percent in Shortleaf Pine/Bluestem Grass/RCW, MA 22

WF003 Provide for and designate areas for mast production at the approximate rate of 20 percent of each project area. Hardwood and hardwood-pine forest types, age 50 and older, comprise this component.

WF004 Retain clumps of deciduous trees at a rate of one-half acre clump per 20 acres of regeneration cutting by even-aged methods in order to create den trees. Retain clumps around existing den trees. In addition, existing den trees will not be felled unless necessary for insect or disease control or to provide for safety.

WF005 Where timber is harvested, retain or create at least two snags per acre, minimum 12-inch diameter at DBH with an objective of 16-inch DBH or larger. Where naturally occurring snags of this size are unavailable or cannot be created, retain or create snags near the required size. Standing snags will not be felled, unless necessary for insect or disease control or to provide for safety.

WF006 Retain or develop mature growth pine habitats (80 years old or greater) and mature growth hardwood habitats (100 years old or greater) at a rate of five percent of each broad cover type within each project analysis area.

WF008 Where open area habitats are not provided by other conditions, develop one permanent wildlife opening, one to five acres per 160 acres of habitat.

WF009 Provide nest structures where suitable natural cavities do not occur and when

needed to accomplish wildlife objectives.

WF010 Where there is no existing water source, provide at least one wildlife pond per 160 acres where needed to accomplish wildlife objectives.

WF011 Wildlife ponds less than one-half surface acre will be managed for native amphibian habitat and not stocked with fish. WF012 Where possible, seasonally close roads during critical periods for wildlife (March–August).

TH009 Upon termination of management activity, decommission and revegetate temporary roads. Effectively block them to normal vehicular traffic within 50 feet of the beginning of the road and include dips and/or waterbars for erosion control. See Table 3.1 for recommended spacing of waterbars. Remove all temporary crossings. Restore the natural contours and slope on temporary road segments that have grades of 14 percent or greater.

TH010 The cleared or excavated size of landings will not exceed that needed for safe efficient skidding and loading operation.