United States Department of the Interior

FISH AND WILDLIFE SERVICE
Missouri Ecological Services Field Office
101 Park DeVille Drive, Suite A
Columbia, Missouri 65203-0057
Phone: (573) 234-2132 Fax: (573) 234-2181

November 3, 2022

Tyson Zobrist
U.S. Army Corps of Engineers
St. Louis District, Regulatory Branch
1222 Spruce Street
St. Louis, Missouri 63103

Subject: Biological Opinion on the Limestone Ridge 138kV Transmission Line (2022-0027859)

Dear Mr. Zobrist:

This document transmits our final biological opinion under section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*) on the proposed Ameren Transmission Company of Illinois (Ameren) Limestone Ridge Transmission Line Project in Perry and Cape Girardeau Counties in Missouri. Your request for formal consultation was received on October 21, 2022. This biological opinion (BO) is based on information provided in the October 21, 2022 Biological Assessment (BA) prepared by HDR, Inc. (HDR) for Ameren on behalf of the U.S. Army Corps of Engineers (USACE), other available literature, survey data, and other sources of information. A complete administrative record of this consultation is on file at the Missouri Ecological Field Office.

The enclosed BO addresses effects of the project, which you have determined is likely to adversely affect the Indiana bat (*Myotis sodalis*). We concur with the likely to adversely affect determination for the Indiana bat and the BO provides a statement of anticipated incidental take as a result of the project. The Incidental Take Statement (ITS) issued exempts the USACE and Ameren from the prohibitions of taking under Section 9 of the Act, provided that such taking is in compliance with the terms and conditions of the ITS.

You have determined that project activities are also likely to adversely affect the northern long-eared bat (*Myotis septentrionalis*) and that activities meet provisions of the final 4(d) rule for the species (USFWS 2016). Any taking that may occur incidental to this project is not prohibited under the final 4(d) rule (50 CFR §17.40(o)). The northern long-eared bat has been included in this BO in the event that the final rule to list the species as endangered and the 4(d) rule is nullified. The analyses and incidental take authorization for northern-long eared bat will not

become fully effective until then, and we will send you a letter updating the biological opinion and authorizing the incidental take contemplated in this BO.

You have determined that project activities may affect, but are not likely to adversely affect the gray bat (*Myotis grisescens*). You have also determined that the proposed project will have no effect on the monarch butterfly *(Danaus plexippus)*. Based on information in the BA and our database review of locations and habitats of these species, we concur with these determinations.

If you have any questions or concerns regarding this consultation and biological opinion, please contact Kathryn Bulliner of this office at 573-476-9136.

Sincerely,

JOHN WEBER

Digitally signed by JOHN WEBER
Date: 2022.11.03 16:08:58 -05'00'

John S. Weber
Acting Field Supervisor

cc: Jaynie Doerr, USACE, St. Louis
Kenneth Lynn, Ameren
Dan Schmidt, Ameren
Brittany Schweiger, HDR, Inc.

BIOLOGICAL OPINION

Limestone Ridge Project: Limestone Ridge 138kV Transmission Line
(2022-0027859)

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

November 3, 2022

TABLE OF CONTENTS

INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) based on our review of activities associated with the Ameren's portion of a new transmission line project, "Limestone Ridge 138kV Transmission Line Project" in Perry and Cape Girardeau Counties, Missouri. Hereafter, we refer to the transmission line project as either "the Project" or "the Transmission Line" for simplicity. This BO evaluates the potential and actual effects of implementation of project activities on the Indiana bat (*Myotis sodalis*) and northern long- eared bat (*Myotis septentrionalis*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

The proposed action includes clearing of existing forested habitat and other activities associated with Ameren Transmission Company of Illinois (Ameren) development of a new 138kV transmission line. The Project area is 293 acres including the footprint of the new transmission and access roads. A portion of the Project area requires a Section 404 (Clean Waters Act) permit issued by the USACE. Also evaluated in the BA are actions implemented by Ameren outside of the USACE's jurisdiction. These activities are similar to those occurring within the USACE jurisdictional boundaries. Formal consultation was initiated on October 21, 2022 upon receipt of the final BA by the Service's Missouri Ecological Services Field Office. The purpose of the formal consultation process is to ensure federal agency activities are not likely to jeopardize the continued existence of any federally listed species or result in the destruction or adverse modification of any designated critical habitat.

This BO is based on information provided in the October 21, 2022 BA prepared by HDR, Inc. (HDR) for Ameren on behalf of the USACE, survey data, other available literature, the 2007 Indiana Bat Draft Recovery Plan (First Revision) (USFWS 2007), and other sources of information available to us and/or in our database. The Service has determined that implementation of the proposed activities described in the BA will not jeopardize the continued existence of the Indiana bat but will result in incidental take of the species. No designated critical habitat will be affected by this action; therefore, no further discussion of critical habitat is included in this BO. The Service has also determined that implementation of the proposed activities described in the BA will not jeopardize the continued existence of the northern long-eared bat, but will result in incidental take of the species. The northern long-eared bat is currently proposed to be reclassified as a federally endangered species, which would nullify the 4(d) rule. The analyses and incidental take authorization for the northern long-eared bat will not become fully effective until that occurs, and we will send you a letter updating the biological opinion and authorizing the incidental take contemplated in this BO. We note that final listing rules do not go into effect until 30 days after their publication in the Federal Register.

On July 5, 2022, the U.S. District Court of the Northern District Court of California vacated the 2019 regulations implementing section 7 of the Endangered Species Act (ESA). On September 21, 2022, the Ninth Circuit Court of Appeals granted a request to stay the U.S. District Court of Northern California's July 5, 2022, order that vacated the 2019 ESA regulations. As a result, the 2019 regulations are again in effect, and the Service has relied upon the 2019 regulations in rendering this biological opinion. However, because the outcome of the legal challenges to 2019 ESA Regulations is still unknown, we considered whether our substantive analyses and conclusions in this consultation would have been different if the pre-2019 regulations were applied. Our analysis included the prior definition of "effects of the action," among other prior terms and provisions. We considered all the "direct and indirect effects" and the "interrelated and interdependent activities" when determining the "effects of the

action." As a result, we determined the substantive analysis and conclusions would have been the same, irrespective of which regulations applied.

CONSULTATION HISTORY

January 31, 2022 – HDR requests project review for listed species by the USFWS.

February 1, 2022 – Email correspondence from USFWS to HDR suggesting a meeting time to discuss the project with HDR.

February 13, 2022 – Conference call between USACE, HDR, Ameren, and USFWS to discuss the project, the species, and necessary surveys needed for the project. Project compliance pathways were also discussed via ESA Section 7 and 10.

March 7, 2022 – Call and email correspondence from HDR to USFWS asking about bat surveys. USFWS provided *Range-wide Indiana Bat and Northern Long-eared Bat Summer Survey Guidelines* and first recommended a habitat assessment and then summer surveys throughout the project area in suitable habitat.

March 16, 2022 – Email correspondence from USFWS to HDC, Ameren, and USACE attaching Missouri's compensatory mitigation options for bats in Missouri.

April 4, 2022 – HDR submitted a bat habitat and impacts memo to USFWS and USACE.

April 12, 2022 – Email correspondence from USFWS to HDR, Ameren, and USACE stating that USFWS was preparing a formal letter in response to the bat habitat and impacts memo and asking for a call to discuss.

April 15, 2022 – Call with USACE and USFWS discussing the small federal handle memo vs. ESA Section 10 approach for the project.

April 25, 2022 – Email correspondence from USFWS to HDR, USACE, and Ameren sending USFWS's formal response to the April 4, 2022 bat habitat assessment and memo along with several examples of Biological Opinions for similar projects.

April 26, 2022 – Conference call with USFWS, HDR, Ameren, and USACE discussing the comment letter and the ESA Section 7 versus Section 10 process. USACE confirmed that the completed wetland delineation was needed to understand how much of the project area would need a Clean Water Act Section 404 permit. HDR responded that it was still in progress.

June 15, 2022 – Email correspondence from USACE and USFWS discussing the project and using the small federal handle if a Section 404 permit would be needed for the project.

July 11, 2022 – HDR submitted a bat habitat assessment report to USFWS.

July 25, 2022 – Email correspondence between USFWS and USACE to discuss the project and the small federal handle.

July 26, 2022 – Conference call with USACE and USFWS discussing the project and the ESA Section 7 approach.

July 27, 2022 – Email correspondence between USFWS, USACE, and HDR, where USFWS provided an example Biological Assessment and walked through the formal consultation process.

July 29, 2022 – Conference call held between USFWS, USACE, HDR, Burns and McDonnell, WVPA, and Ameren to discuss both projects and the preparation of a BA.

August 9, 2022 – Email correspondence from USFWS to HDR, Ameren, and USACE providing feedback on the bat habitat assessment.

August 31, 2022 – Email correspondence from HDR to USFWS, USACE, and Ameren stating that tree clearing has been reduced within the project area and requested a conference call to discuss of mitigation options for the project. USFWS responded with our availability.

September 7, 2022 – Conference call held between USFWS, USACE, HDR and Ameren to discuss mitigation options. USFWS suggested that Ameren reach out to MDC regarding mitigation opportunities.

October 9, 2022 – Email correspondence from HDR to USFWS and USACE stating the plan to use the Magnolia Conservation Bank. USFWS responded with the corrected ratio required since the project is in the secondary service area.

October 21, 2022 – USACE submitted the Biological Assessment to USFWS.

October 21, 2022 – USFWS sent our formal initiation letter to USACE.

October 22, 2022 – Email correspondence from USFWS to USACE clarifying the action area within USACE's jurisdiction. USACE responded with the acreage.

October 27, 2022 – USFWS submitted draft Biological Opinion to USACE.

October 31, 2022 – Email correspondence from USFWS to USACE requesting the mitigation credit purchase agreement in order to release the final signed Biological Opinion for the project. USACE responded saying that they were waiting to receive the document from Ameren and would send it once received.

November 3, 2022 – USACE submitted Ameren's mitigation credit purchase agreement.

November 3, 2022 – Final Biological Opinion signed and submitted to USACE.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

Section 7(a)(2) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.) requires that Federal agencies shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of critical habitat. When the actions of a Federal agency may adversely affect a protected species, that agency (i.e., the action agency) is required to consult with either the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (Service), depending upon the protected species that may be affected.

The USACE is issuing permits under Section 404 of the Clean Water Act to Ameren for activities related to the construction of a new 15-mile 138kV transmission line. The project area is located in Perry and Cape Girardeau Counties, Missouri (Figure 1). According to the information provided in the BA and during project meetings, the actions are necessary to provide reliable power to customers in Perry and Cape Girardeau Counties, Missouri and to comply with standards of the North American Electric Reliability Corporation (NERC).

The proposed Project consists of the construction of a new 138kV transmission line between the proposed Wittenberg and Whipple substations, the creation of new 125-ft right-of-way (ROW), the expansion of existing ROW to 124-ft and 17-miles of 30-ft wide access roads. The Project area is 293 acres. Tree clearing will occur on 123 acres, with 4.1 acres in the USACE jurisdiction (Table 1) of suitable bat habitat. The remaining 118.9 acres are on privately owned lands or other non-federal properties. A total of 8 acres of suitable habitat will be avoided.

Construction related to the Transmission Line Project is scheduled to commence November 1, 2022 and conclude June 30, 2024. Tree clearing associated with the Project is expected to commence on November 1, 2022 and be completed by March 31, 2023. If Ameren is unable to complete tree clearing by April 1st, tree felling may continue until May 1, 2023 or after August 31, 2023. Ameren will prioritize tree felling of suitable roosting habitat in November 2022.

Ameren will construct the 138kV transmission line within both the existing and new ROW. These ROWs will be maintained throughout construction and for future access to the transmission line. Ameren will utilize 17 miles of existing public and private roads to access the ROW. Some access roads will require tree clearing to accommodate equipment needed for the Project. The Project will include 94 steel monopole structures secured on concrete foundations. After construction activities are completed, all temporary workspaces will be restored to their original grade and revegetated. Additionally, Ameren will install permanent erosion and sedimentation control systems.

Continued operations and maintenance actions will be required by Ameren following the completion of the proposed activities. Actions will include periodic mowing, vegetation clearing within the ROW (no tree clearing), and line inspections to monitor and maintain proper operation. Ground crews will use the existing access roads to enter the ROW. No additional tree clearing is anticipated.

For actions occurring within the USACE jurisdiction, the USACE will issue permits to Ameren to authorize project activities.

TABLE 1: Amount of tree clearing of suitable bat habitat required for the proposed project.

Location of Forested Habitat Removal	Amount of Forested Habitat to be Removed (acres)
USACE jurisdiction	4.1
Outside USACE Jurisdiction	118.9
All Lands Combined	123

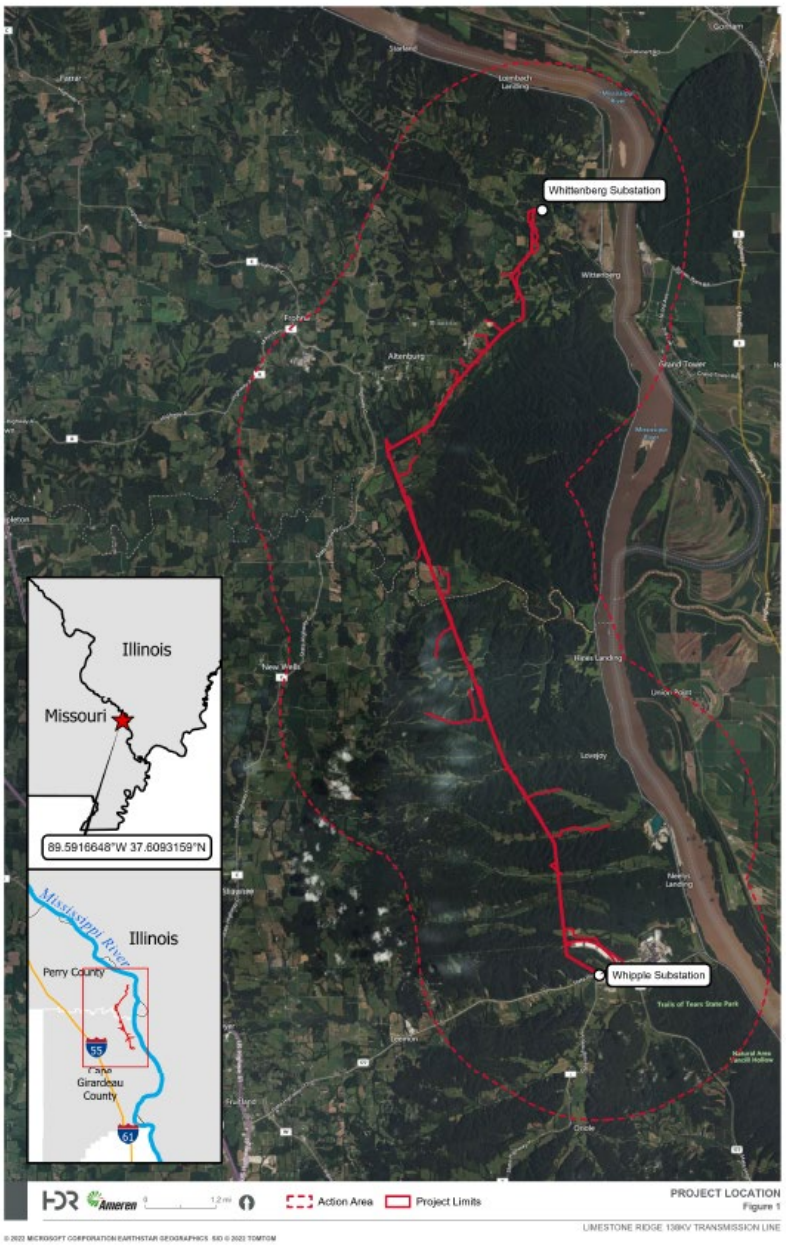

FIGURE 1. The general vicinity of the project area with the proposed Transmission Line (solid red line) located between the proposed Whittenberg and Whipple Substations (labeled). The Project is located in Perry and Cape Girardeau Counties, Missouri. The action area (dashed red line) includes the project area plus 2.5-mi buffer to account for Indiana bat home range size.

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 USACE 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.

Conservation Measures

Conservation measures represent actions outlined in the project description that the action agency will implement to further the recovery of the species under review. As outlined in the October 21, 2022 BA, Ameren has committed to implement the following conservation measures in Missouri to minimize potential impacts to the Indiana bat:

- The entirety of tree removal within suitable habitat areas is proposed to occur within the winter hibernation period (November 1 – March 31). If all tree felling activities cannot be completed prior to April 1, tree felling will likely continue until May 1 or be conducted after August 31, outside of the non-volant pup season.
- Eight acres of suitable bat habitat within the Action Area will be avoided and retained.
- Indirect effects resulting in habitat loss will be mitigated at a 1.5:1 ratio, per the USFWS Voluntary Compensatory Mitigation Options for the Indiana Bat and Northern Long-eared Bat in Missouri (USFWS 2018), equating to a mitigation offset of 123 acres. Therefore, 184.5 acres of bat habitat mitigation credits will be purchased from the South Fabius Conservation Bank.
- Project route/alignment has been selected to minimize tree clearing to the extent practicable.
- Biological monitors will mark potentially suitable maternity roosting trees prior to access road construction for avoidance purposes.

- The Project construction ROW will be clearly marked to help ensure that contractors do not accidentally remove more trees than necessary.
- Water trucks will be used to dampen disturbed soils to control fugitive dust when construction causes dust that affects forested areas when roosting bats may be present (most frequently in summer, but also in spring and autumn).
- All known rock outcroppings and potential caves/karst areas near the Project will be avoided.
- As a part of revegetation efforts within the Project ROW, Ameren will include various species of milkweed (*Asclepias* spp.) that occur within southeast Missouri and are known be the monarch butterfly's preferred food and reproductive source to create new habitat for this species

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 Code of Federal Regulations [CFR] 402.02). The Action Area is defined by measurable or detectable changes in land, air, and water or to other measurable factors that would result from the proposed action. The Action Area is not limited to the "footprint" of the project but rather encompasses the aerial extent of the biotic, chemical, and physical impacts to the environment resulting from the action.

Because disturbance or removal of roosts within the project area could disrupt Indiana bat and northern long-eared bat dynamics throughout the rest of the home range, the Action Area for the proposed transmission line includes the project area plus a 2.5-mi[1] (4.0-km) radius around the project area, for a total of 66,214.4 acres (Figure 1).

II. STATUS OF THE SPECIES

This section presents the biological or ecological information relevant to formulating this BO. Appropriate information on the species' life history, its habitat and distribution, and other data on factors necessary to its survival are included to provide background for analysis in later sections. This analysis documents the effects of past human and natural activities or events that have led to the current range-wide status of the species. Portions of this information are also presented in listing documents, the recovery plan (USFWS 1983), and the draft recovery plan, and first revision (USFWS 2007) and available literature.

Species Description

Indiana Bat

The Indiana bat was originally listed as an endangered species by the Service in 1967. Thirteen winter hibernacula (11 caves and two mines) in six states were designated as critical habitat for the Indiana bat in 1976 (USFWS 1976). Six of these hibernacula are in Missouri.

The Indiana bat is an insectivorous, temperate, medium-sized bat that migrates annually from winter hibernacula to summer habitat in forested areas. The bat has a head and body length that ranges from 41 to 49 mm, with a forearm length of 35 to 41 mm. The fur is described as dull pinkish-brown on the back but somewhat lighter on the chest and belly, and the ears and wing membranes do not contrast

[1] The 2.5-mi (4.0-km) radius represents what the Service considers is the average radius of an Indiana bat's home range.

with the fur (Barbour and Davis 1969). Although the bat resembles the little brown bat and the northern long-eared bat, it is distinguished by its distinctly keeled calcar.

Northern Long-eared Bat

The northern long-eared bat was proposed for federal listing as endangered on 2 October 2013. On 2 April 2015, the species was given a proposed listing of threatened with a 4(d) rule (USFWS 2015). No critical habitat has been proposed for the species. On March 23, 2022, the Service published a proposal to reclassify the northern long-eared bat as endangered under the Endangered Species Act. Following a court order by the U.S. District Court for the District of Columbia, the Service must complete a new final listing determination for the northern long-eared bat by November 2022 (Case 1:15-cv-00477, March 1, 2021). The proposed reclassification, if finalized, would remove the current 4(d) rule for the northern long-eared bat, as these rules may be applied only to threatened species. The northern long-eared bat is a medium-sized bat about 3 to 3.7 inches in length, but with a wingspan of 9 to 10 inches. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, *Myotis*, which are generally bats noted for their small ears.

Life History and Biology

The key stages in the annual cycle of Indiana bats and northern long-eared bats are: hibernation, spring staging, pregnancy, lactation, volancy/weaning, migration, and swarming. While there is variation based on weather and latitude, generally bats begin winter torpor in mid-September through late-October and begin emerging in April. Females depart shortly after emerging and are pregnant when they reach their summer area. Birth of young occurs between mid-June and early July and then nursing continues until weaning, which is shortly after young become volant (able to fly) in mid- to late-July. Migration back to the hibernaculum may begin in August, peak in September, and continue into October.

Winter Hibernation

Indiana Bats

After the summer maternity period, Indiana bats migrate back to traditional winter hibernacula. Some male bats may begin to arrive at hibernacula as early as July. Females typically arrive later and by September the number of males and females are present in comparable numbers. Autumn “swarming” occurs prior to hibernation. During swarming, bats fly in and out of cave entrances from dusk to dawn and use trees and snags as day roosts (Cope and Humphrey 1977). Swarming continues for several weeks and mating occurs during the latter part of the period. Fat supplies are replenished as the bats forage prior to hibernation. By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females.

All cohorts of Indiana bats are hibernating by November and remain in hibernacula through April (Hall 1962, LaVal and LaVal 1980), depending upon local weather conditions. Indiana bats hibernate in caves and mines with cold, stable microclimates. They form large, dense clusters, ranging from 300 bats per square foot to 484 bats per square foot (Clawson et al. 1980, Clawson, pers. observ. October 1996 in USFWS 2000). Clusters form in the same area in a cave each year, with more than one cluster possible in a particular cave (NatureServe 2007). Banding of Indiana bats demonstrates, especially with females, philopatry to hibernacula (i.e., they return annually to the same hibernaculum).

Northern Long-eared Bats

Northern long-eared bats are thought to predominantly overwinter in hibernacula that include caves and abandoned mines. These hibernacula have relatively constant, cooler temperatures with high humidity and no strong currents (Fitch and Shump 1979; van Zyll de Jong 1985; Raesly and Gates 1987; Caceres and Pybus 1997). Northern long-eared bats are typically found roosting singly or in small numbers in cave or mine walls or ceilings, often in small crevices or cracks, sometimes with only the nose and ears visible and thus are easily overlooked during surveys (Griffin 1940; Barbour and Davis 1969; Caire et al. 1979; Van Zyll de Jong 1985; Caceres and Pybus 1997; Whitaker and Mumford 2009).

Northern long-eared bats have also been observed overwintering in other types of habitats that have similar conditions (e.g., temperature, humidity levels, air flow) to cave or mine hibernacula. The species may use these alternate hibernacula in areas where caves or mines are not present (Griffin 1945). Northern long-eared bats have been found using the following alternative hibernacula: abandoned railroad tunnels (USFWS 2015), the entrance of a storm sewer in central Minnesota (Goehring 1954), a hydroelectric dam facility in Michigan (Kurta et al. 1997), an aqueduct in Massachusetts (Massachusetts Department of Fish and Game 2012, unpublished data), a dry well in Massachusetts (Griffin 1945). More recently, northern long-eared bats were found in a crawl space within a dwelling in Massachusetts (Dowling and O'Dell 2018) and a rock crevice in Nebraska (White et al. 2020). Further, Girder et al. (2016) found northern long-eared bat to be present and active year-round on the coastal plain of North Carolina, where there is no known non- cavernicolous (cave-like) hibernacula; therefore, it is possible this population was not (traditionally) hibernating. Also, in coastal North Carolina, northern long-eared bats were observed to be active the majority of the winter, and although torpor was observed, time spent in torpor was very short with the longest torpor bout (i.e., hibernation period) for each bat averaging 6.8 days (Jordan 2020).

Summer Roosting and Foraging

Indiana Bats

After hibernation ends in late March or early April, most Indiana bats and northern-long eared bats migrate to summer roosts. Females emerge from hibernation ahead of males. Reproductively active females store sperm from autumn copulations through winter, and ovulation takes place after the bats emerge from hibernation. The period after hibernation and just before spring migration is referred to as “staging,” a time when bats forage and a limited amount of mating occurs (USFWS 2007). In spring when fat reserves and food supplies are low and females are pregnant, migration is probably hazardous (Tuttle and Stevenson 1977). Consequently, mortality may be higher in the early spring, immediately following emergence. Once en route to their summer destination, females move quickly across the landscape. Radio-telemetry studies in New York documented females flying between 10 and 30 miles in one night after release from their hibernaculum, arriving at their maternity sites within one night. Indiana bats can migrate hundreds of miles from their hibernacula. Observed migration distances range from just 34.1 mi to 356.5 mi (USFWS 2007).

Females seek suitable habitat for maternity colonies, which is a requisite behavior for reproductive success. They exhibit strong site fidelity to summer roosting and foraging areas, generally returning to the same summer range annually to bear their young (Garner and Gardner 1992). For example, surveys conducted in summer 2014 in a maternity colony home range first documented in 1985, indicated continued presence of a maternity colony in the area. Females arrive in their summer habitats as early as April 15 in Illinois (Garner and Gardner 1992), and usually start grouping into larger maternity colonies by mid-May. Garner and Gardner (1992) reported that Indiana bats first

arrived at their maternity roost in early May in Indiana, with many individuals arriving in mid-May. During this early spring period, a number of roosts may be used temporarily until a roost with larger numbers of bats is established.

In general, Indiana bats roost in large, often dead or partially dead trees with exfoliating bark and/or cavities and crevices (Callahan et al. 1997; Farmer et al. 2002; Kurta et al. 2002). Trees in excess of 16-inch diameter at breast height (dbh) with exfoliating bark are considered optimal for maternity colony roost sites, but trees in excess of 9 inches dbh appear to provide suitable maternity roosting habitat (Romme et al. 1995). Rittenhouse et al. (2007) considered roost trees as suitable at approximately 7 inches dbh, but the suitability index (SI, SI = 0.00 to 1.00) of roost trees increased with greater dbh with trees reaching a SI of 0.50 at approximately 12 inches dbh and a SI of 1.00 at approximately 20 inches dbh or greater. Indiana bat maternity roosts can be described as primary or alternate based upon the proportion of bats in a colony consistently occupying the roost site. Maternity colonies typically use 10 to 20 trees each year, but only one to three of these are primary roosts used by the majority of bats for some or all of the summer (Garner and Gardner 1992; Miller et al. 2002). Alternate roosts are used by individuals, or a small number of bats, and may be used intermittently throughout the summer or used only once or for a few days. Females frequently switch roosts to find optimal roosting conditions, switching roosts every few days on average, although the reproductive condition of the female, roost type, and time of year affect switching. When switching between day roosts, Indiana bats may travel as little as 23 feet or as far as 3.6 miles (Kurta et al. 1996; Kurta et al. 2001; Kurta et al. 2002). In general, moves are relatively short and typically less than 0.6 mile (USFWS 2017).

Maternity colonies typically contain 100 or fewer adult females (Harvey 2002), but as many as 384 have been observed from a single maternity roost tree in Indiana (Whitaker and Brack 2002). The average sized maternity colony in Indiana was 80 females (Whitaker and Brack 2002). Birth of young occurs in late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977). The young are able to fly between mid-July and early August (Mumford and Cope 1958, Cope et al. 1974, Humphrey et al. 1977, Clark et al. 1987, Gardner et al. 1991, Kurta et al. 1996). An exit count conducted on July 17, 2014 on U.S. Army Corps of Engineers property (Wappapello Lake) in Missouri yielded a count of 195 individuals exiting a 26-inch dbh cottonwood snag (York- Harris, pers. comm). Volant pups likely were included in the count, but at least 96 adults were present in the primary tree.

The home range of a maternity colony is the area within a 2.5-mile radius (i.e., 12,560 acres) around documented roosts or within a 5-mile radius (i.e., 50,265 acres) around capture location of a reproductive female or juvenile Indiana bat or a positive identification of Indiana bat from properly deployed acoustic devices and acceptable analysis of data. Based on data provided in the Indiana bat draft revised recovery plan (USFWS 2007), a maternity colony needs at least 10% suitable habitat (i.e., forested habitat that provides adequate roost sites and foraging areas) to exist at a given point on the landscape. Garner and Gardner (1992) found that females in Illinois utilized larger foraging ranges than males, whereas Menzel et al. (2005) found no difference in home range sizes of males and females in west-central Illinois.

Male Indiana bats may be found throughout the entire range of the species. Some males spend the summer near hibernacula, as has been observed in Missouri (LaVal and LaVal 1980) and West Virginia (Stihler, pers. observ. October 1996, in USFWS 2000). Males appear to roost singly or in

small groups, except during brief summer visits to hibernacula. Males have been observed roosting in trees as small as 3 inches dbh, but the average roost diameter for male Indiana bats is 13 inches (USFWS 2007).

Indiana bats forage over a variety of habitat types but prefer to forage in and around the tree canopy of both upland and bottomland forest, along roads, or along the corridors of small streams. Menzel et al. (2005) found that females foraged significantly closer to forests, roads, and riparian habitats than agricultural land and grasslands. Womack et al. (2012) documented selection by reproductive females of forests with higher canopy cover but more open mid-stories caused by management via prescribed fire. Females in Illinois were found to forage most frequently in areas with canopy cover of greater than 80% (Garner and Gardner 1992). Bats forage between dusk and dawn at a height of approximately 6-90 feet above ground level and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects (Humphrey et al. 1977).

Northern Long-eared Bats

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

Most foraging occurs above the understory, 1 to 3 m (3 to 10 ft) above the ground, but under the canopy (Nagorsen and Brigham 1993) on forested hillsides and ridges, rather than along riparian areas (LaVal et al. 1977; Brack and Whitaker 2001). This coincides with data indicating that mature forests are an important habitat type for foraging northern long-eared bats (Caceres and Pybus 1997; White et al. 2017). Foraging also takes place over small forest clearings and water, and along roads (Van Zyll de Jong 1985). Northern long-eared bat seem to prefer intact mixed-type forests with small gaps (i.e., forest trails, small roads, or forest-covered creeks) in forest with sparse or medium vegetation for forage and travel rather than fragmented habitat or areas that have been clear cut (USFWS 2015; USFWS 2022).

Northern long-eared bats typically roost singly or in maternity colonies underneath bark or more often in cavities or crevices of both live trees and snags (Sasse and Pekins 1996; Foster and Kurta 1999; Owen et al. 2002; Carter and Feldhamer 2005; Perry and Thill 2007; Timpone et al. 2010). Males' and non-reproductive females' summer roost sites may also include cooler locations, such as caves and mines (Barbour and Davis 1969; Amelon and Burhans 2006). Studies have documented the northern long-eared bat's selection of both live trees and snags (Sasse and Pekins 1996; Foster and Kurta 1999; Lacki and Schwierjohann 2001; Menzel et al. 2002; Carter and Feldhamer 2005; Perry and Thill 2007; Timpone et al. 2010). Northern long-eared bats are flexible in tree species selection and while they may select for certain tree species regionally, likely are not dependent on certain species of trees for roosts throughout their range; rather, many tree species that form suitable cavities or retain bark will be used by the bats opportunistically (Foster and Kurta 1999; Silvis et al. 2016; Hyzy 2020).

To a lesser extent, northern long-eared bats have also been observed roosting in colonies in human-made structures, such as in buildings, in barns, on utility poles, behind window shutters, in bridges, and in bat houses (Mumford and Cope 1964; Barbour and Davis 1969; Cope and Humphrey 1972;

Burke 1999; Sparks et al. 2004; Amelon and Burhans 2006; Whitaker and Mumford 2009; Timpone et al. 2010; Bohrman and Fecske 2013; Feldhamer et al. 2003; Sasse et al. 2014; USFWS 2015; Dowling and O'Dell 2018). It has been hypothesized that use of human-made structures may occur in areas with fewer suitable roost trees (Henderson and Broders 2008; Dowling and O'Dell 2018). In north-central West Virginia, northern long-eared bats were found to more readily use artificial roosts as distance from large forests (greater than 200 hectares [494 acres]) increased, suggesting that artificial roosts are less likely to be selected when there is greater availability of suitable roost trees (De La Cruz et al. 2018).

Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009) to 60 individuals (Caceres and Barclay 2000); however, larger colonies of up to 100 adult females have been observed (Whitaker and Mumford 2009). Most studies have found that the number of individuals roosting together in a given roost typically decreases from pregnancy to post-lactation (Foster and Kurta 1999; Lacki and Schwierjohann 2001; Garroway and Broders 2007; Perry and Thill 2007; Johnson et al. 2012). Northern long-eared bats exhibit fission-fusion behavior (Garroway and Broders 2007), where members frequently coalesce to form a group (fusion), but composition of the group is in flux, with individuals frequently departing to be solitary or to form smaller groups (fission) before returning to the main spatially discrete unit or network (Barclay and Kurta 2007). As part of this behavior, northern long-eared bats switch tree roosts often (Sasse and Pekins 1996), typically every 2 to 3 days (Foster and Kurta 1999; Owen et al. 2002; Carter and Feldhamer 2005; Timpone et al. 2010). Patriquin et al. (2016) found that northern long-eared bat roost switching and use varies regionally in response to differences in ambient conditions (e.g., precipitation, temperature).

Adult females give birth to a single pup (Barbour and Davis 1969). Birthing within the colony tends to be synchronous, with the majority of births occurring around the same time (Krochmal and Sparks 2007). Parturition (birth) may occur as early as late May or early June (Easterla 1968; Caire et al. 1979; Whitaker and Mumford 2009) and may occur as late as mid-July (Whitaker and Mumford 2009). Juvenile volancy (flight) often occurs by 21 days after birth (Kunz 1971; Krochmal and Sparks 2007) and has been documented as early as 18 days after birth (Krochmal and Sparks 2007; USFWS 2022).

Population Status and Distribution

Indiana Bats

The population of the Indiana bat has decreased significantly from an estimated 808,000 in the 1950s (USFWS 2007). Based on censuses taken at all hibernacula, the current total known Indiana bat population in 2019 is estimated to number approximately 537,297, which represents a 4% decline since 2017 and a 19% decline since 2007 when White-nose Syndrome (WNS) was first discovered in the United States.

Missouri, Indiana, and Kentucky have historically had the highest estimated numbers of hibernating Indiana bats; all had estimates of greater than 10,000 bats in 1965. Over the period 1965 to 2005, estimated numbers of hibernating bats in Missouri and Kentucky clearly declined (USFWS 2007). Among the group of states in which aggregate hibernaculum surveys have never reached 100,000 bats, hibernaculum surveys in Arkansas, Tennessee, and Virginia consistently declined from 1965 to 2000. Hibernacula surveys in Illinois, New York, Ohio, and West Virginia were greater in 2000 than in 1965, but trends are not entirely consistent through the period. Thus, the southern tier of states in the

species' range shows declines in counts at hibernacula, whereas some states in the upper Midwest show increasing counts (USFWS 2007).

The current species range for the Indiana bat includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida. The species has disappeared from, or greatly declined, in most of its former range in the northeastern United States. The current revised recovery plan (USFWS 2007) delineates recovery units based on population discreteness, differences in population trends, and broad level differences in land-use and macro-habitats. There are currently four recovery units for the Indiana bat: Ozark-Central, Midwest, Appalachian Mountains, and Northeast.

Historically, the Indiana bat winter range was restricted to areas of cavernous limestone in the karst regions of the east-central United States. Hibernacula are divided into groups and defined in the Service's Draft Recovery Plan (USFWS 2007): Priority 1 (P1) hibernacula typically have a current and/or historically observed winter population of greater than or equal to 10,000 Indiana bats; P2 have a current or observed historic population of 1,000 or greater, but fewer than 10,000; P3 have current or observed historic populations of 50 to 1,000 bats; and P4 have current or observed historic populations of fewer than 50 bats. Based on 2009 winter surveys, there were a total of 24 P1 hibernacula in seven states: Illinois (one); Indiana (seven); Kentucky (five); Missouri (six); New York (three); Tennessee (one); and West Virginia (one). One additional P1 hibernaculum was discovered in Missouri in 2012. A total of 55 P2, 151 P3, and 229 P4 hibernacula are also known from the aforementioned states, as well as 15 additional states.

The historical summer range of the Indiana bat is similar to its modern range. However, the bat has been locally extirpated due to loss of summer habitat. The majority of known maternity sites have been located in forested tracts and riparian areas in agriculturally dominated landscapes such as Missouri, Iowa, Indiana, Illinois, southern Michigan, western Ohio, and western Kentucky. They have been documented to use roost trees in highly fragmented areas as well as more contiguous forested patches.

The Indiana bat populations in the Ozark-Central Recovery Unit (RU) have declined significantly since 1990 but has been relatively stable from 2009 to 2019 (USFWS 2017, 2019a, 2019b). Historically, the Ozark-Central Recovery Unit had the largest numbers of Indiana bats in hibernacula; however, populations have declined such that the Midwest RU unit hosts the largest populations of Indiana bats. Prior to 2012, the majority of hibernating bats in the Ozark-Central RU were assumed to overwinter in Pilot Knob Mine in Missouri. Dramatic declines in the hibernating population at this site occurred since the early 1980s from an original estimation of approximately 100,000 in the 1970s to an estimation of 1,678 in the 2000s. The discovery of the *Sodalis* Nature Preserve population in Hannibal, Missouri has increased the baseline size of the population in the Ozark-Central RU, but not the overall trend across the range of the species. Based on observations by private cavers, the site has been occupied by Indiana bats since the 1970s. These bats are not considered to be bats that moved from Pilot Knob Mine following a partial collapse of the mine. In 2017, *Sodalis* Nature Preserve housed approximately 197,000 hibernating Indiana bats. The survey in 2019 showed the first signs of a WNS- caused decline in this population with the count being approximately 180,000 hibernating Indiana bats. The 2019 population estimate for the Ozark- Central RU is approximately 271,965.

Northern Long-eared Bat

The northern long-eared bat was once abundant throughout much of the eastern United States prior to the onset of WNS and thus, was not a focus of detailed demographic studies. USFWS estimated the U.S. population in 2016 to be 6,500,000 individuals (adults and juveniles; USFWS 2015). However, catastrophic population declines have been continuing across the species' range since the emergence of WNS.

Available evidence, including both winter and summer data, indicates northern long-eared bat abundance has and will continue to decline substantially over the next 10 years under current demographic conditions. Evidence of the past decline is demonstrated in available data in both winter and summer. For example, range wide winter abundance has declined by 49% and the number of extant winter colonies (populations) by 81%. There has also been a noticeable shift towards smaller colony sizes, with a 96–100% decline in the number of large hibernacula (≥100 individuals). Although the declines are widespread, the magnitudes of the winter declines vary spatially. In the Eastern Hardwoods, the core of species' range, abundance declined by 56% and the number of sites by 88%. Abundance and the number of sites declined in the remaining 4 RPUs (87% and 82% - East Coast RPU, 90% and 44% - Midwest RPU, 24% and 70% - Southeast RPU, and 0% and 40% - Subarctic RPU, respectively). Across all RPUs, the potential of population growth is low; the probability of RPU growth rates (λ) ≥1 ranges from 0 to 11% (USFWS 2022).

Declining trends in abundance and occurrence are also evident across much of northern long-eared bat's summer range. Based on derived range wide summaries from Stratton and Irvine (2022), range wide occupancy has declined by 80% from 2010–2019 (Table A-3B4, Figure 5.7). Although these declines attenuate westward, the probability of occupancy declined in all RPUs (Table A- 3B4). Similarly, Whitby et al. (2022), using data collected from mobile acoustic transects, found a 79% decline in range wide relative abundance from 2009–2019. Measurable declines were also found in the Midwest RU (91%) followed by the Eastern Hardwoods (85%), East Coast (71%), and Southeast (57%) RPUs. Data were not analyzed in the Subarctic RPU due to a lack of observations. Finally, Deeley and Ford (2022) observed a significant decrease in mean capture rate post-WNS arrival. Estimates derived from their results indicted a 43–77% decline in summer mist net captures compared pre and post arrival of WNS (USFWS 2022).

Threats

Indiana Bats

The reasons for listing the Indiana bat were summarized in the original Recovery Plan (USFWS 1983) including: declines in populations at major hibernacula despite efforts to implement cave protection measures, the threat of mine collapse and the potential loss of largest known hibernating population at Pilot Knob Mine, Missouri, and other hibernacula throughout the species range were not adequately protected. Although several known human-related factors have caused declines in the past, they may not solely be responsible for recent declines. Documented causes of Indiana bat population decline include: 1) human disturbance of hibernating bats; 2) improper cave gates and structures rending them unavailable or unsuitable as hibernacula; and 3) natural hazards like cave flooding and freezing. Suspected causes of Indiana bat declines include: 1) changes in the microclimate of caves and mines; 2) dramatic changes in land use and forest composition; and 3) chemical contamination from pesticides and agricultural chemicals. Current threats from changes in land use and forest composition include forest clearing on private and public land within the summer range, woodlot management and wetland drainage by landowners, and other private and municipal land management activities that affect the structure and abundance of forest resources.

Northern Long-eared Bats

Although there are countless stressors affecting northern long-eared bats, the primary factor influencing the viability of the species is white-nose syndrome (WNS), a disease of bats caused by a fungal pathogen. Other primary factors influencing the northern long-eared bat's viability include wind energy mortality, effects from climate change, and habitat loss (USFWS 2022).

Habitat Loss

Habitat loss may include loss of suitable roosting or foraging habitat, resulting in longer flights between suitable roosting and foraging habitats due to habitat fragmentation, fragmentation of maternity colony networks, and direct injury or mortality. Loss of or modification of winter roosts (i.e., making hibernaculum no longer suitable) can result in impacts to individuals or at the population level (USFWS 2022).

White-nose Syndrome

White-nose syndrome (WNS) was first documented in New York in February of 2006 and has since been confirmed in 20 states and 4 Canadian Provinces www.whitenosesyndrome.org/resources/map). It has been correlated with erratic behavior such as early or mid-hibernation arousal that leads to emaciation and mortality in several species of bats, including the Indiana bat and northern long-eared bat (http://whitenosesyndrome.org/; www.fws.gov). WNS is thought to be transmitted by direct bat contact with an infected bat and by transmission of the causative agent from cave to cave. The distribution of WNS appears to be expanding in all directions from its epicenter in New York. Between 2007 and 2008, it was documented to have spread from a 9 km radius to a 200 km radius, and at the end of the 2008-2009 winter, it was documented in all major hibernacula in New York. More recently it has been found throughout Missouri, northern Alabama, Illinois, and suspected in eastern Iowa. The Service and partners are conducting research to develop management strategies to reduce the spread and impacts of WNS. However, it remains a significant and immediate threat to the Indiana bat. At the time the revised recovery plan was drafted in 2007, the causative agent for WNS had not yet been discovered (now known to be caused by the fungus *Pseudogymnoascus destructans*), and the additive impacts to the already declining Indiana bat were not yet considered. Given the documented deaths of Indiana bat due to WNS in the Northeast since 2006, the species is further threatened with extinction. Numerous research projects have been completed and are ongoing at a rapid rate since the first discovery of WNS, a national response plan has been completed (available at www.whitenosesyndrome.org), multiple states and agencies have approved or are in the process of developing response action plans, and various management actions have been undertaken with the hope of slowing the spread of the disease (e.g., cave closures, the development of decontamination protocols, etc.). Despite these efforts, there is no known cure for the disease and all bats in North America that hibernate in caves could be detrimentally impacted and, in some cases, threatened with extinction.

Overall mortality rates have ranged from 90 to 100 percent in Indiana bat hibernacula in the northeastern United States. It is currently estimated that 5.7 to 6.7 million bats of all species have died from WNS in infected regions (www.whitenosesyndrome.org/about-white-nose- syndrome). Apparent losses of 685 Indiana bats in Hailes Cave and 12,890 (previous population was 13,014) Indiana bats in the Williams Preserve Mine in New York were documented during the first winter WNS was observed at each site. Additionally, Indiana bat surveys conducted at hibernacula in New York during early 2008 estimated the population declined 15,662 bats, which represents 3.3% of the 2007 revised

rangewide population estimate. The number of confirmed cases of WNS has increased significantly in the Ozark-Central Recovery Unit since 2011 (www.whitenosesyndrome.org/resources/map) and if trends continue, it is likely that additional reductions in the Indiana bat population will occur in this region.

WNS has been the foremost stressor on the northern long-eared bat for more than a decade. The fungus that causes the disease, *Pseudogymnoascus destructans* (Pd), invades the skin of bats, and infection leads to increases in the frequency and duration of arousals during hibernation and eventual depletion of fat reserves needed to survive winter, and often results in mortality. WNS has caused estimated northern long-eared bat population declines of 97–100% across 79% of the species' range (USFWS 2022).

Wind Energy
Wind energy-related mortality of Indiana bat and northern long-eared bat is also proving to be a consequential stressor at local and regional levels, especially in combination with impacts from WNS (USFWS 2016). Most bat mortality at wind energy projects is caused by direct collisions with moving turbine blades. Wind energy mortality may occur over 49% of the northern long-eared bat range (USFWS 2022).

Climate Change
Climate change is an emerging threat to the Indiana bat, primarily because temperature is an essential feature of both hibernacula and maternity roosts. Potential impacts of climate change on temperatures within Indiana bat hibernacula were reviewed by V. Meretsky (pers. comm., 2006 in USFWS 2007). Climate change may be implicated in the disparity of population trends in southern versus northern hibernating populations of Indiana bats (Clawson 2002), but Meretsky noted that confounding factors are clearly involved. Potential impacts of climate change on hibernacula can be compounded by mismatched phenology in food chains (e.g., changes in insect availability relative to peak energy demands of bats) (V. Meretsky, pers. comm., 2006 in USFWS 2007). Changes in maternity roost temperatures may also result from climate change, and such changes may have negative or positive effects on development of Indiana bats, depending on the location of the maternity colony. The effect of climate change on Indiana bat populations is a topic deserving additional consideration.

Climate change variables, such as changes in temperature and precipitation, may influence northern long-eared bat resource needs, such as suitable roosting habitat for all seasons, foraging habitat, and prey availability. Although there may be some benefit to northern long-eared bat from a changing climate, overall negative impacts are anticipated, especially at local levels (USFWS 2022).

III. ENVIRONMENTAL BASELINE

The environmental baseline is the current status of listed species and their habitats, and critical habitat, as a result of past and ongoing human and natural factors in the area of the proposed action. Also included in the environmental baseline are the anticipated impacts of other proposed Federal projects in the action area that have already undergone formal section 7 consultation.

Status of the Species Within the Action Area

As noted previously, the Action Area for this consultation includes the project area plus a 2.5-mi (4.0-

km) radius around the transmission line project area, for a total of 66,214.4 acres (Figure 1). Surveys were not conducted for this project because Indiana bat presence was already documented within the action area. Surveys were conducted in 2012 and documented capture location and roost tree approximately 1.5 miles of the proposed transmission line. Ameren conducted a bat habitat assessment and decided to assume presence of Indiana bat and northern long-eared bat due to the 2012 records.

The Apple Creek Conservation Area (CA) overlaps 5,268.22 acres (8.5%) of the Action Area. Apple Creek Conservation Area is located in northeast Cape Girardeau County and consists of 2,100.2 acres managed by Missouri Department of Conservation

Factors Affecting the Species within the Action Area

This section describes factors affecting the environment of the species or critical habitat in the Action Area. The environmental baseline includes state, tribal, local, and private actions already affecting the species or that will occur contemporaneously with the consultation in progress. Related and unrelated Federal actions affecting the same species and critical habitat that have completed formal or informal consultation are also part of the environmental baseline, as are Federal and other actions within the Action Area that may benefit listed species or critical habitat.

Factors affecting the Indiana bat and northern long-eared bat environment within and adjacent to the Action Area are expected to be the same as those described under the Status of the Species section. Landownership in the Action Area is 92.5% private and 8.5% public, with the public portion being owned and managed by the Missouri Department of Conservation. Current land-use in the Action Area varies but is primarily forested, and agricultural with some commercial/residential developments. Agricultural areas with row crops or open fields are mostly in the north portion of the action area with isolated pockets throughout the remaining action area. Suitable habitat remains for listed bat species in forested areas.

IV. 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.

As described previously, the proposed Project will involve the removal of a combined acreage of 123 acres of forested habitat (Table 1) within and outside the USACE jurisdictional area, all of which may provide suitable roosting habitat for Indiana and northern long-eared bats. Though bat surveys have not been conducted within the project footprint, these species are known to occur within the action area and may be present throughout forested habitat within the project area based on the suitability of habitat and records of Indiana bats and northern long-eared bats to the east of the Project within the action area. Therefore, at least one maternity colony of both species may be affected by this project.

Because up to 123 acres of forested habitat will be removed as part of project activities, there will be a loss of roosting and foraging habitat for the Indiana and northern long-eared bats. The likely behavioral response of bats returning in the spring if a previously utilized tree was removed will be to disperse to adjacent suitable habitat. However, dispersal to adjacent suitable habitat may affect the species in the

short term by causing increased energetic demands, exposure to inter and intra-specific competition, and exposure to predation while searching unfamiliar habitat for new roosting and foraging areas if high quality roosting habitat is not available in close proximity to their previous maternity area. Loss of familiar roost trees and associated foraging habitat, while adverse in the short term, however, are not expected to have long term consequences for a colony because of the remaining forested habitat within the known foraging range of the Indiana bat (Sparks et.al. 2005) and the propensity of the species to utilize alternative roost sites (Carter and Feldhammer 2005).

Indiana bats and northern long-eared bats may also be affected if primary maternity roost trees (i.e., occupied in the summer) are cleared during the hibernation period (inactive season). Removal of maternity roost trees during this time renders them unavailable to pregnant bats that exhibit maternity area and/or maternity roost tree fidelity following migration in the spring. Active primary maternity roost trees are larger trees that are rare across the landscape, and we do not have complete understanding of how they are selected. It can be difficult for a maternity colony to find a suitable replacement even if a suite of alternate maternity roost trees in the area are already being used. Periods of pregnancy, birth, and lactation are the most sensitive and energetically demanding times of year for reproductive females. Resulting impacts from the loss of maternity trees during these periods may include a reduction in foraging, increases in energetic demands, exposure to inter and intra-specific competition, exposure to predation, and decreases in the long-term reproductive success and viability of the colony in the area. This substantial habitat modification may result in harm by significantly impairing behavioral patterns, including breeding, feeding, or sheltering within a maternity colony.

We expect the majority of adverse effects to occur within the first year of the Project after the trees are removed and bats return to the area and disperse to adjacent suitable habitat if a previously utilized tree has been removed. Although we expect there may be harm to Indiana bats and northern long-eared bats through the loss 123 acres of suitable roosting and foraging habitat, we do not anticipate that the effects to individuals will result in the loss of local maternity colonies. At most, we anticipate short-term harm from the removal of suitable roosting habitat.

Compensatory Mitigation

According to information provided in the BA, compensatory mitigation will be provided by Ameren to offset the loss of Indiana bat summer habitat. In the Final BA, Ameren proposes to compensate for the loss of 123 acres of suitable roost habitat for the Indiana bat by purchasing 184.5 credits of bat habitat mitigation from the Service approved South Fabius Conservation Bank. The applicant will demonstrate their purchase of the habitat mitigation credits to the Service prior to the release of the final BO. Although conducting mitigation will not avoid potential impacts from the removal of forested habitat within the project area, the preservation of foraging and roosting habitat through the mitigation will help compensate for the potential adverse effects to the Ozark Central Recovery Unit from project activities.

V. 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.

State, local, and private actions not associated with the proposed action (e.g., development, agriculture, etc.) are likely to continue throughout the action area. These State, local, and private actions are likely to result in varying degrees of adverse effects to the Indiana bat and northern long-eared bat. Therefore, cumulative effects are likely to occur. Within Missouri, numerous cumulative effects that can have long-term, continuous impacts on the Indiana bat and northern long-eared bat in the future are related, but not limited, to: activities related to timber harvest, land conversion, agriculture and livestock production, and recreational activities. While impacts of these activities are likely occurring to individuals, we do not consider these impacts to affect the persistence or reproductive potential of Indiana bats as a whole because Indiana bat range- wide population is mostly stable despite these threats, while northern long-eared bats greatest threat and declines are as a result from white-nose syndrome.

Similarly, there are future actions of the State, research centers, municipalities, and private landowners that can aid in the recovery of species or preserve the baseline status of the species. These actions include, but are not limited to: preservation of private forest land through conservation easements, preservation of additional public land through private land acquisition, implementation of the MDC Comprehensive Wildlife Conservation Strategy, and implementation of MDC's Bat Conservation Plan.

VI. CONCLUSION

After reviewing the current status of the Indiana bat and northern long-eared bat, the environmental baseline for the Action Area, effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed project is not likely to jeopardize the continued existence of the Indiana bat or northern long-eared bat. Although some individual Indiana bats or northern long eared-bats may be harmed by the action, we do not anticipate at the recovery unit level. This determination is based on the following considerations: 1) the proposed action will only affect a portion of the Action Area and will not substantially alter the overall availability of Indiana bat and northern long-eared bat habitat within the Action Area, 2) there will be no net loss of Indiana bat or northern long-eared bat foraging or roosting habitat since compensatory mitigation will be provided by Ameren, and 3) the proposed Action Area is small relative to either species range. There is no critical habitat for the Indiana bat in the project area; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering [50 CFR §17.3]. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(a)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement (ITS).

The measures described below are non-discretionary, and must be undertaken so that they become binding conditions of any grant, permit, or action for the exemption of Section 7(o)(2) to apply. The USACE has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the USACE fails to adhere to the terms and conditions of the Incidental Take Statement, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the USACE must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement, pursuant to 50 CFR § 402.14(i)(3).

The incidental take for the northern long-eared bat will not become fully effective unless the northern long-eared bat is reclassified to endangered.

Amount or Extent of Take Anticipated

As described under the EFFECTS OF THE ACTION section, incidental take of the Indiana bat and northern long-eared bats may occur in the form of harm from the removal of suitable roosting and known foraging habitat. The Service anticipates that actual incidental take of the Indiana bat and northern-long eared bat as a result of the project evaluated in this biological opinion will be difficult to quantify and detect due to the bat's small body size, widely dispersed individuals under loose bark or in cavities of trees, and unknown areal extent and density of the roosting and foraging populations within the project area.

Monitoring to determine take of individual bats within an expansive area of forested habitat is a complex and arduous task. Unless every individual tree that contains suitable roosting habitat is inspected by a knowledgeable biologist before tree clearing activities begin, it would be impossible to know if a roosting Indiana bat or northern long-eared bat is present in an area proposed clearing. Inspecting individual trees is not considered by the Service to be a practical survey method and is not recommended as a means to determine incidental take. Therefore, we will use the areal extent of potential roosting and foraging habitat affected as a surrogate to monitor the level of take. The Service anticipates that no more than 123 acres of occupied Indiana bat and northern long-eared bat habitat will be disturbed as a result of project activities, with 4.1 acres occurring within the USACE's jurisdiction and 118.9 acres outside of USACE jurisdiction on private lands (Table 2). We expect take to occur within in the period of one year from November 1, 2022 to October 31, 2023. This includes the removal of trees during the winter of 2022 and

potentially in the spring (April 1-May 1) and fall (August 1-October 31) of 2023, and subsequently, indirect effects would occur when Indiana bats and northern long-eared bats return in the spring and disperse to adjacent suitable habitat if a previously utilized tree has been removed.

TABLE 2. Amount of tree clearing required for the proposed project.

Location of Forested Habitat Removal	Total (acres)
Within USACE Jurisdiction	4.1
Outside USACE Jurisdiction	118.9

If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation. In this case, the USACE or Ameren must also immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures provided.

Effect of the Take

Overall, the harm, injury, or death of individuals caused by the removal of 123 acres of suitable Indiana bat roosting habitat is not likely to affect the status of Indiana bats in the Ozark-Central Recovery Unit. In the accompanying opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the Indiana bat.

The removal of known foraging and suitable northern long-eared bat roosting habitat is also not likely to affect the status of northern long-eared bats. In the accompanying opinion, the Service determined that this level of anticipated take is not likely jeopardize the continued existence of the northern long-eared bat

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the incidental take of the Indiana bat and northern long-eared bat:

1. The USACE will ensure that the conservation measures outlined under the Description of the Proposed Action are implemented.
2. Report to the Service when project activities have been implemented.

Terms and Conditions

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

1. Implement conservation measures identified in the Biological Assessment
    a. Ameren must implement the Conservation Measures as described in Section I – Description of the Proposed Action.
2. Applicant shall immediately contact the Service's Missouri Ecological Services Field Office at (573) 476-9136 to report direct encounters between listed species and Project workers and their equipment whereby incidental take in the form of harm, injury, or death occurs. If the encounter occurs after normal working hours, the Applicant shall contact the Missouri Ecological Services

Field Office at the earliest possible opportunity the next working day. When injured or killed individuals of the listed species are found, the USACE shall follow the steps outlined below.

3. Injured listed species must be cared for by a licensed veterinarian or other qualified persons. Dead individuals must be sealed in a resealable plastic bag containing a paper with the date and time when the animal was found, the location where it was found, and the name of the person who found it, and the bag containing the specimen frozen in a freezer located in a secure site, until instructions are received from the Service regarding the disposition of the dead specimen.
4. Report to the Service when tree clearing is completed.
    a. The USACE should contact Kathryn Bulliner of our office at Kathryn_Bulliner@fws.gov (573-476-9136) when the USACE permits have been issued to Ameren.
    b. Ameren or HDR should contact Kathryn Bulliner of our office at Kathryn_Bulliner@fws.gov (573-476-9136) once all tree clearing has taken place.
    c. Ameren or HDR should contact Kathryn Bulliner of our office at Kathryn_Bulliner@fws.gov (573-476-9136) once all of the remaining project activities have been completed.

CONSERVATION RECOMMENDATIONS

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

The Service as identified the following actions that would further the conservation of federally listed bats:

1. Develop and implement guidelines for the future development of power transmission lines and/or substations, outside the Project boundaries, for the protection of bat habitat, including seasonal clearing restrictions.

2. Control non-native and invasive species within suitable bat habitat.

REINITIATION NOTICE

This concludes formal consultation on the proposed Limestone Ridge Transmission Line Project. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the action agency that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the action is subsequently modified in a manner that causes an effect to listed or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

LITERATURE CITED

Amelon, S., and D. Burhans. 2006. Conservation assessment: *Myotis septentrionalis* (northern long-eared bat) in the eastern United States. Pages 69–82 in Conservation assessments for five forest bat species in the eastern United States, Thompson, F. R., III, editor. U.S. Department of Agriculture, Forest Service, North Central Research Station, General Technical Report NC-260. St. Paul, Minnesota. 82pp.

Barbour, R.W. and W.H. Davis. 1969. Bats of America. University Press of Kentucky, Lexington. 286 pp.

Barclay, R.M.R. and Kurta A. 2007. Ecology and behavior of bats roosting in tree cavities and under bark. Bats in Forests: Conservation and Management. Pp 17-60.

Bohrman, J., and D. Fecske. 2013. White-Nose Syndrome Surveillance and Summer Monitoring of Bats at Great Swamp National Wildlife Refuge, Morris County, New Jersey. A final report prepared for United States Fish and Wildlife Service, 115pp.

Brack V. Jr., and J.O. Whitaker. 2001. Foods of the northern *Myotis*, *Myotis septentrionalis*, from Missouri and Indiana, with notes on foraging. Acta Chiropterologica, 3(2):203–210.

Burke, H.S. Jr. 1999. Maternity colony formation in *Myotis septentrionalis* using artificial roosts: the rocket box, a habitat enhancement for woodland bats? Bat Research News, 40:77–78.

Caceres, M.C., and R.M.R. Barclay. 2000. *Myotis septentrionalis*. Mammalian Species, 634:1–4.

Caire, W., R.K. LaVal, M.L. LaVal, and R. Clawson. 1979. Notes on the ecology of *Myotis keenii* (Chiroptera, Vespertilionidae) in Eastern Missouri. American Midland Naturalist, 102(2): 404–407.

Callahan, E. V.; Drobney, R. D.; Clawson, R. L. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalis*) in Missouri. Journal of Mammalogy. 78: 818-825.

Carter, T.C., and G.A. Feldhamer. 2005. Roost tree use by maternity colonies of Indiana bats and northern long-eared bats in southern Illinois. Forest Ecology and Management 219, no. 2-

Clark, B.K., J.B. Bowles, and B.S. Clark. 1987. Summer status of the endangered Indiana bat in Iowa. American Midland Naturalist 118:32-39.

Clawson, R.L. 2002. Trends in population size and current status. Pp. 2-8 in A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

Clawson, R.L., R K. LaVal, M.L. LaVal, and W. Caire. 1980. Clustering behavior of hibernating *Myotis sodalis* in Missouri. Journal of Mammalogy, 61:245-253.

Cope, J. B., and S. R. Humphrey. 1977. Spring and autumn swarming behavior in the Indiana bat, *Myotis sodalis*. Journal of Mammalogy, 58:93-95.

Cope, J.B., A.R. Richter, and R.S. Mills. 1974. Concentrations of the Indiana bat, *Myotis sodalis*, in Wayne County, Indiana. Proceedings of the Indiana Academy of Science. 83:482-484

Cope, J.B., and S.R. Humphrey. 1972. Reproduction of the bats *Myotis Keenii* and Pipistrellus subflavus in Indiana. Bat Research News, 13:9–10.

De la Cruz, J.L., R.L. Ward, and E.S. Schroder. 2018. Landscape characteristics related to use of artificial roosts by northern long-eared bats in north-central West Virginia. Northeastern Naturalist, 25(3):487–501.

Deeley, S.M., and W.M. Ford. 2022. Summary Assessment of USFWS Capture Data for Little Brown, Northern Long-eared, and Tricolored Bat Species Status Assessment. Chapter A in Straw, B.R, J. A. Martin, J.D. Reichard, and B.E. Reichert, editors.

Analytical Assessments in Support of the U.S. Fish and Wildlife Service 3-Bat Species Status Assessment. Cooperator Report prepared in cooperation with the U.S. Geological Survey
Dowling, Z.R., and D.I. O'Dell. 2018. Bat use of an island off the coast of Massachusetts. Northeastern Naturalist, 25(3):362–382.
Easterla, D. A., and L. C. Watkins. 1969. Pregnant *Myotis sodalis* in northwestern Missouri. Easterla, D.A. 1968. Parturition of Keen's *Myotis* in Southwestern Missouri. Journal of Mammalogy, 49(4):770.
Farmer, A.H., B.S. Cade, and D.F. Staufer. 2002. Evaluation of a habitat suitability index model. Pp. 172-179 *in*. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.
Feldhamer, G.A., T.C. Carter, A.T. Morzillo, and E.H. Nicholson. 2003. Use of bridges as day roosts by bats in southern Illinois. Transactions of the Illinois State Academy of Science, 96(2): 107–112
Fitch, J.H., and K.A. Shump, Jr. 1979. *Myotis keenii*. Mammalian Species, 121:1–3.
Foster, R.W., and A. Kurta. 1999. Roosting ecology of the Northern bat (*Myotis septentrionalis*) and comparisons with the endangered Indiana bat (*Myotis sodalis*). Journal of Mammalogy, 80(2):659–672.
Gardner, J. E., J. D. Garner, and J. E. Hofmann 1991. Summer roost selection and roosting behavior of *Myotis sodalis* (Indiana bat) in Illinois. Final report. Illinois Natural History Survey, Illinois Dept. of Conservation, Champaign, IL. 56 pp.
Garner, J.D. and J.E. Gardner. 1992. Determinations of summer distribution and habitat utilization of the Indiana bat (*Myotis sodalis*) in Illinois. Final Report: Project E-3.
Garroway, C.J., and H.G. Broders. 2007. Nonrandom association patterns at northern long- eared bat maternity roosts. Canadian Journal of Zoology, 85:956–964.
Girder, J.F., A.L. Larson, J.A. Homyack, and M.C. Kalcounis-Rueppell. 2016. Winter activity of coastal plain populations of bat species affected by White-Nose Syndrome and wind energy facilities. PLoS ONE 11(11): e0166512. doi:10.1371/journal.pone.0166512.
Goehring, H.H. 1954. *Pipistrellus subflavus obscurus*, *Myotis keenii*, and *Eptesicus fuscus* hibernating in a storm sewer in central Minnesota. Journal of Mammalogy, 35(3):434–436.
Griffin, D.R. 1940. Reviewed notes on the life histories of New England cave bats. Journal of Mammalogy, 21(2):181–187.
Griffin, D.R. 1945. Travels of banded cave bats. Journal of Mammalogy, 26(1):15–23. Gumbert, M.W., O'Keefe, J.M., and MacGregor, J.R. 2002. Roost Fidelity in Kentucky. The Indiana Bat: Biology and Management of an Endangered Species, A. Kurta and J. Kennedy, eds. Austin TX: Bat Conservation International, pp 143-152.
Hall, J.S. 1962. A life history and taxonomic study of the Indiana bat, *Myotis sodalis*. Gallery Publication 12. Reading Public Museum, Reading, PA. 68 pp.
Harvey, M.J. 2002. Status and ecology in the southern United States. Pp. 29-34. in A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
Henderson, L.E., and H.G. Broders. 2008. Movements and resource selection of the northern long-eared *Myotis* (*Myotis septentrionalis*) in a forest-agriculture landscape. Journal of Mammalogy, 89(4):952–963.
Humphrey, S.R., A.R. Richter, and J.B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. Journal of Mammalogy, 58:334-346.

Hyzy, B.A., R.E. Russel, A. Silvis, W.M. Ford, J. Riddle, and K. Russel. 2020. Investigating maternity roost selection by northern long-eared bats at three sites in Wisconsin. Endangered Species Research, 41:55–65, 2020.

Johnson, J.B., W.M. Ford, and J.W. Edwards. 2012. Roost networks of northern *Myotis* (*Myotis septentrionalis*) in a managed landscape. Forest Ecology and Management, 266:223-231.

Jordan, G. W. 2020. Status of an Anomalous Population of Northern Long-Eared Bats in Coastal North Carolina. Journal of Fish and Wildlife Management 11(2):665–678. Journal of Mammalogy, 50:372-373.

Krochmal, A.R., and D.W. Sparks. 2007. Timing of Birth and Estimation of Age of Juvenile *Myotis septentrionalis* and *Myotis lucifugus* in West–Central Indiana. Journal of Mammalogy, 88(3):649–656.

Kunz, T.H. 1971. Reproduction of Some Vespertilionid Bats in Central Iowa. American Midland Naturalist, 86(2):477–486.

Kurta, A., J. Caryl, and T. Tipps. 1997. Bats and Tippy Dam: species composition, seasonal use, and environmental parameters. Michigan Academician, 29(4):473–490.

Kurta, A., K.J. Williams, and R. Mies. 1996. Ecological, behavioural, and thermal observations of a peripheral population of Indiana bats (*Myotis sodalis*). Pp. 102-117 *in* R.M.R. Barclay and R. M. Brigham (eds.), Bats and Forests Symposium. Research Branch, British Columbia Ministry of Forests, Victoria, BC, Canada.

Kurta, A., S.W. Murray, and D. Miller. 2001. The Indiana bat: journeys in space and time. Bat Research News. 42(2): 31. Abstract.

Kurta, A., S.W. Murray, D.H. Miller. 2002. Roost selection and movements across the summer landscape. In: Kurta, Allen; Kennedy, Jim, eds. The Indiana bat: biology and management of an endangered species. Austin, TX: Bat Conservation International: 118- 129.

Lacki, M.J. and J.H. Schwierjohann. 2001. Day-roost characteristics of northern bats in mixed mesophytic forest. The Journal of Wildlife Management, 65(3):482–488.

LaVal, R.K. and M.L. LaVal. 1980. Ecological studies and management of Missouri bats, with emphasis on cave-dwelling species. Missouri Dept. of Conservation Terrestrial Series 8:1-53.

LaVal, R.K., R.L. Clawson, M.L. LaVal and W. Caire. 1977. Foraging Behavior and Nocturnal Activity Patterns of Missouri Bats, with Emphasis on the endangered species *Myotis grisescens* and *Myotis sodalis*. Journal of Mammalogy, 58(4):592– 599.

Menzel, J.M., W.M. Ford, M.A. Menzel, T.C. Carter, J.E. Gardner, J.D. Garner, and J.E. Hofmann. 2005. Summer habitat use and home-range analysis of the endangered Indiana bat. Journal of Wildlife Management 69:430-436.

Menzel, M.A., S.F. Owen, W.M. Ford, J.W. Edwards, P.B. Wood, B.R. Chapman, and K.V. Miller. 2002. Roost tree selection by northern long-eared bat (*Myotis septentrionalis*) maternity colonies in an industrial forest of the central Appalachian Mountains. Forest Ecology and Management, 155:107–114.

Miller, N.E, R.D. Drobney, R.L. Clawson, and E.V. Callahan. 2002. Summer habitat in northern Missouri. In: Kurta, Allen; Kennedy, Jim, eds. The Indiana bat: biology and management of an endangered species. Austin, TX: Bat Conservation International: 165-171. Mumford R.E., and J.B. Cope. 1964. Distribution and status of the chiroptera of Indiana. American Midland Naturalist, 72(2):473–489.

Mumford, R.E., and J.B. Cope. 1958. Summer record of *Myotis sodalis* in Indiana. Journal of Mammalogy 39:586-587.

Nagorsen, D.W. and R.M. Brigham. 1993. Bats of British Columbia. Royal British Columbia Museum, Victoria, and the University of British Columbia Press, Vancouver. 164 pp.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia.

Owen, S.F., M.A. Menzel, W.M. Ford, J.W. Edwards, B.R. Chapman, K.V. Miller, and P.B. Wood. 2002. Roost tree selection by maternal colonies of Northern long-eared *Myotis* in an intensively managed forest. USDA Forest Service. Newtown Square, Pennsylvania. 10 pp.

Patriquin, K.J., M.L. Leonard, H.G. Broders, W.M. Ford, E.R. Britzke, and A. Silvis. 2016. Weather as a proximate explanation for fission–fusion dynamics in female northern long-eared bats. Animal Behaviour 122:47–57.

Perry, R.W., and R.E. Thill. 2007. Roost selection by male and female northern long-eared bats in a pine-dominated landscape. Forest Ecology and Management 247:220–226.1. Pgs. 259-268.

Raesly, R.L., and J.E. Gates. 1987. Winter habitat selection by north temperate cave bats. American Midland Naturalist, 118(1):15–31.

Rittenhouse, C.D., W.D. Dijak, F.R. Thompson III, and J.J. Millspaugh. 2007. Development of landscape-level habitat suitability models for ten wildlife species in the central hardwoods region. General Technical Report NRS – 4. U.S. Department of Agriculture, Forest Service, Northern Research Station, Newtown Square, PA, USA.

Romme. R.C., K. Tyrell, and V. Brack, Jr. 1995. Literature summary and habitat suitability index model: components of summer habitat for the Indiana bat, *Myotis sodalis*. Report submitted to the Indiana Dept. Natural Resources, Div. of Wildlife, Bloomington, IN by 3D/Environmental Services, Inc., Cincinnati, OH. Fed. Aid Project E-1-7, Study No. 8. 38pp.

Sasse, D.B., and P.J. Pekins. 1996. Summer roosting ecology of northern long-eared bats (*Myotis septentrionalis*) in the white mountain national forest. Bats and Forests Symposium October 1995, Victoria, British Columbia, Canada, pp. 91–101.

Sasse, D.B., M. L. Caviness, M. J. Harvey, J. L. Jackson, and P. N. Jordan. 2014. Journal of the Arkansas Academy of Science 68(32):170–173.

Silvis, A., R.W. Perry, and W.M. Ford. 2016. Relationships of three species of bats impacted by White-Nose Syndrome to forest condition and management. Gen. Tech. Rep. SRS–214. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 48 p.

Sparks, D.W., C.M. Ritzi, J.E. Duchamp, and J.O. Whitaker. 2005. Foraging habitat of the Indiana bat (*Myotis sodalis*) at an urban-rural interface. Journal of Mammology 86:713- 718.

Sparks, J.K., B.J. Foster, and D.W. Sparks. 2004. Utility pole used as a roost by a northern Myotis, *Myotis septentrionalis*. Bat Research News, 45:94.

Stratton, C., and K.M. Irvine. 2022. Summertime Analysis Statistical Report for Little Brown, Northern Long-eared, and Tricolored Bat Species Status Assessment. Chapter B in Straw, B.R, J. A. Martin, J.D. Reichard, and B.E. Reichert, editors.

Analytical Assessments in Support of the U.S. Fish and Wildlife Service 3-Bat Species Status Assessment. Cooperator Report prepared in cooperation with the U.S. Geological Survey, United States Fish and Wildlife Service and Bat Conservation International. https://doi.org/10.7944/P9B4RWEU

Timpone, J.C., J.G. Boyles, K.L. Murray, D. P. Aubrey, and L.W. Robbins. 2010. Overlap in roosting habits of Indiana bats (*Myotis sodalis*) and northern bats (*Myotis septentrionalis*). The American Midland Naturalist 163:115-123.

Tuttle, M.D. and D.E. Stevenson. 1977. An analysis of migration as a mortality factor in the gray bat based on public recoveries of banded bats. American Midland Naturalist. 97:235-240.

USFWS (U.S. Fish and Wildlife Service). 1976. Determination of critical habitat for American Crocodile, California Condor, Indiana Bat, and Florida Manatee. Federal Register 41: 41914-41416.

USFWS (U.S. Fish and Wildlife Service). 1983. Recovery plan for the Indiana bat. U.S. Fish and Wildlife Service, Washington, D.C. 80 pp.

USFWS (U.S. Fish and Wildlife Service) 2000. Biological Opinion for the Nantahala and Pisgah National Forests Land and Resource Management Plan, Amendment 5, on the Indiana bat. Asheville Ecological Services Field Office, Asheville, NC. 89 pp.

USFWS (U.S. Fish and Wildlife Service). 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. Fort Snelling, MN. 258 pp.

USFWS (U.S. Fish and Wildlife Service). 2015. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat With 4(d) Rule; Final Rule and Interim Rule. Federal Register 80(63): 17974–18033.

USFWS (U.S. Fish and Wildlife Service). 2016. Draft Midwest Wind Energy Multi-species Habitat Conservation Plan in collaboration with the States of Iowa, Illinois, Indiana, Michigan, Minnesota, Missouri, and Wisconsin and the American Wind Energy Association. Public Review Draft. April 2016.

USFWS (U.S. Fish and Wildlife Service). 2017. 2017 Indiana Bat (*Myotis sodalis*) Population Status Update. Indiana Ecological Field Office. Revised July 5, 2017.

USFWS (U.S. Fish and Wildlife Service). 2019a. 2019 Indiana Bat (*Myotis sodalis*t) Population Status Update. Compiled by Andy King. Indiana Ecological Services Field Office. June 2019.

USFWS (U.S. Fish and Wildlife Service). 2019b. White-Nose Syndrome. A Coordinated Response to the Devastating Bat Disease. June 2019.

USFWS (U.S. Fish and Wildlife Service). 2022. Species Status Assessment Report for the Northern long-eared bat (*Myotis septentrionalis*) March 2022.

Van Zyll de Jong, C.G. 1979. Distribution and systematic relationships of long-eared *Myotis* in western Canada. Canadian Journal of Zoology, 57:987–994.

Whitaker, J.O., and R.E. Mumford. 2009. Northern *Myotis*. pp. 207–214. In Mammals of Indiana. Indiana University Press, Bloomington, Indiana. 688pp.

Whitaker, J.O., Jr. and V. Brack, Jr. 2002. Distribution and summer ecology in Indiana. Pp. 48- 54 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

Whitby, M., B.J. Udell, A.M. Wiens, T. Cheng, W. Frick, B.E. Reichert, and J.D. Reichard. 2022. Summer Mobile Acoustic Transect Analysis for Little Brown, Northern Long-eared, and Tricolored Bat Species Status Assessment. Chapter C in Straw, B.R, J. A. Martin, J.D. Reichard, and B.E. Reichert, editors. Analytical Assessments in Support of the U.S. Fish and Wildlife Service 3-Bat Species Status Assessment. Cooperator Report prepared in cooperation with the U.S. Geological Survey, United States Fish

and Wildlife Service and Bat Conservation International. https://doi.org/10.7944/P9B4RWEU

White, J.A., P.W. Freeman, H.W. Otto, and C.A. Lemen. 2020. Winter use of a rock crevice by northern long-eared *Myotis* (*Myotis septentrionalis*) in Nebraska. Western North American Naturalist: Vol. 80: No. 1, Article 14.

White, J.W., P. Freeman, C. A. Lemen. 2017. Habitat selection by the Northern Long-eared *Myotis* (*Myotis septentrionalis*) in the Midwestern United States: Life in a shredded farmscape. Transactions of the Nebraska Academy of Sciences and Affiliated Societies 37: 1–10.

Womack, K.M., S.K. Amelon, and F.R. Thompson. 2012. Resource selection by Indiana bats during the maternity season. Journal of Wildlife Management 77:707-715.