

# United States Department of the Interior



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November 30, 2017

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U.S. Army Corps of Engineers  
St. Louis District  
1222 Spruce Street  
St. Louis, Missouri 63103-2833

Subject: 2017-F-0719; Biological Opinion on the Wappapello Lake Timber Stand Improvement Management Strategies ([Compartment.Stand] 2.3, 2.7, 2.12, 6.15)

Dear Dr. Allen,

This document transmits our final biological opinion based on our review of the U.S. Army Corps of Engineers (USACE) proposed third phase of the Wappapello Lake Timber Stand Improvement (TSI) Management Strategies under section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your request for formal consultation was received electronically on July 31, 2017. This biological opinion is based on information provided in the July 2017 Biological Assessment, other available literature, personal communications with experts on federally listed species that occur at Wappapello Lake, and other sources of information. A complete administrative record of this consultation is on file at this office.

The enclosed biological opinion addresses effects of the project, which the USACE has determined is likely to adversely affect the Indiana bat (*Myotis sodalis*). The biological opinion provides a statement of anticipated incidental take as a result of the project.

The USACE has determined that project activities also are 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). We concur with your determination that the northern long-eared is likely to be adversely affected and that activities meet provisions of the final 4(d) rule and comply with associated conservation measures. Any taking that may occur incidental to this project is not prohibited under the final 4(d) rule (50 CFR §17.40(o)). Because effects from activities meeting these provisions were already evaluated in a programmatic biological opinion issued by the Service on January 5, 2016 (USFWS 2016), no further evaluation of effects is

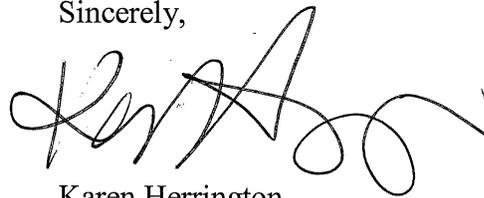
required. The programmatic biological opinion satisfies the USACE's responsibilities under ESA section 7(a)(2) relative to the northern long-eared bat for this project.

In the event that future surveys document the presence of a maternity roost or hibernaculum of northern long-eared bat within the project area, we recommend that measures outlined in the Service's January 5, 2016 Programmatic biological opinion be implemented so that any incidental take is still exempted per the final 4(d) rule. Additionally, we ask that you contact this office for any roosts or hibernacula discovered.

The USACE has determined that project activities may affect, but are not likely to adversely affect the gray bat (*Myotis grisescens*), rabbitsfoot mussel (*Quadrula cylindrica cylindrica*), and snuffbox mussel (*Epioblasma triquetra*) and that project activities are not likely to destroy or adversely modify designated critical habitat for the rabbitsfoot mussel. Based on information in the BA and in our files, we concur with these determinations.

If you have any questions or concerns regarding this consultation and biological opinion, please contact Shauna Marquardt of this office at 573/234-2132, extension 174.

Sincerely,

A handwritten signature in black ink, appearing to read 'Karen Herrington', with a large, stylized flourish at the end.

Karen Herrington  
Field Supervisor

Enclosure

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## **INTRODUCTION**

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) based on our review of the Timber Stand Improvement (TSI) Management Strategies – Phase III, for activities proposed on Army Corps of Engineers (USACE) land at Lake Wappapello in Wayne County, Missouri. Effects from Phases I and II of the management strategies were evaluated in 2012 and 2015, respectively (USFWS 2012, USFWS 2015). This B evaluates the potential and actual effects of implementation of the management strategies on the Indiana bat (*Myotis sodalis*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

As stated in the Biological Assessment (BA), the TSI management strategies are intended to ensure the long range protection of the forest environment and support the practice of uneven aged management and diversification of species within the compartments, establishing a more stable biotic community. The fundamental timber management program goals are to improve the reservoir watershed habitats through best management practices (BMP's) that reduce erosion, and regenerate and promote forest tree and shrub species that benefit wildlife. The actions associated with this project involve roosting and foraging habitat modification in the summer range of the Indiana bat. In the BA prepared by the USACE, adverse effects were identified and measures to avoid and minimize impacts to the species were provided.

Formal consultation was initiated on July 31, 2017 via an email from the USACE to the Service's Missouri Ecological Services Field Office. The purpose of the formal consultation process is for the Service to write a biological opinion that addresses the adverse effects identified in the BA submitted by the USACE.

This BO is based on information provided in the July 2017 BA prepared by the USACE, survey data, personal communications with experts on federally listed species that occur at Wappapello Lake, the 2007 Indiana Bat Draft Recovery Plan (First Revision) (USFWS 2007), and other sources of information available to us and/or in our files. The Service has determined that implementation of the management strategies described in the BA will not jeopardize the continued existence of the Indiana bat but will result in incidental take of the species.

## **CONSULTATION HISTORY**

July 26, 2017 – Telephone call between USACE and USFWS to discuss the Phase III consultation.

July 31, 2017 – USACE email transmitting BA to the USFWS

August 30, 2017 – USFWS email acknowledging receipt of the BA

October 6, 2017 – USFWS email transmitting Draft BO to the USACE

November 6, 2017 – USACE email to the USFWS transmitting comments on the draft BO

# **BIOLOGICAL OPINION**

## **I. DESCRIPTION OF THE PROPOSED ACTION**

The USACE proposes to implement the third phase of the Timber Stand Improvements (TSI) Management Strategies on property adjacent to Wappapello Lake in Wayne County, Missouri. Single tree selection forest management will be conducted on approximately 410 acres in two compartments and four stands (Compartment 2, Stands 3, 7 and 12; Compartment 6, Stand 15); See Appendix A). Single tree selection is the selective removal of low quality, cull, diseased, over-mature or undesirable trees from a stand to achieve target stocking and wildlife habitat objectives. This technique is used in uneven-aged management to encourage wider distribution of tree diameters, dominant species, age class and enhancement of forest reproduction. Because of the nature of the work and unanticipated weather events, tree felling and removal is proposed to take place throughout the year. This includes mid-March through November 1st when timber cutting is normally prohibited in order to protect Indiana bats in their summer habitats.

Acreages of proposed treatment are: 80 acres Compartment 2, Stand 3; 160 acres in Compartment 2, Stand 7; 20 acres in Compartment 2, Stand 12; and 150 acres in Compartment 6, Stand 15. Basal area in each stand will be reduced as determined by existing stand conditions such as; tree stocking percentage, individual tree species health, and amount of desirable hardwood regeneration present.

Physical treatment of all stands will take approximately one year to complete. This timeline may be reduced or slightly exceeded during periods of above-average precipitation when soils are too saturated for operation and movement of equipment.

### **Conservation Measures**

Conservation measures represent actions pledged in the project description that the action agency will implement to further the recovery of the species under review. Conservation measures implemented to minimize harm to listed species which are proposed by the action agency are considered part of the project and their implementation is required under the terms of this consultation.

The USACE is committed to incorporating and implementing the following measures into the project design for the proposed action.

- Dead trees, in addition to den trees and trees with splits, would be targeted for retention. This retention combined with natural recruitment of diseased and dying timber would provide quality roosting habitat for bat species. Additionally, shellbark/shagbark hickory and sycamore would be favored for retention due to their exterior bark characteristics and den qualities.
- Timber haul roads throughout the stands would be located on or within ridge tops, agricultural fields, interior roads, or prior existing roads. Landings would be established where necessary on ridge tops and flat areas suitable for access and appropriate to provide minimal soil disturbance. Harvesting would be accomplished through use of a

rubber-tired skidder and chainsaw felling. Skid trail locations would utilize existing openings within each forest stand.

- Intermittent and perennial streams, in addition to ephemeral drainages, are present within and adjacent to the forest stands. A “no harvest” buffer would be incorporated around the streams to prevent soil, bank, and bed disturbance. These streams/drainage features have been delineated and would be avoided during implementation of timber stand improvement actions.

### **Action Area**

The Action Area includes all areas to be affected directly or indirectly by the Federal action, and not merely the immediate area involved in the action (50 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 maternity colony dynamics throughout the rest of the home range, the action area for the Wappapello TSI Management Strategies-Phase III includes the treatment areas plus a 4.02 km (2.5 mi)<sup>1</sup> radius around the treatment areas. Thus, the total action area comprises a total of 61,588 acres.

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<sup>1</sup> The 4.02 km (2.5 mi) radius represents what the Service considers is the average home range of an Indiana bat maternity colony.

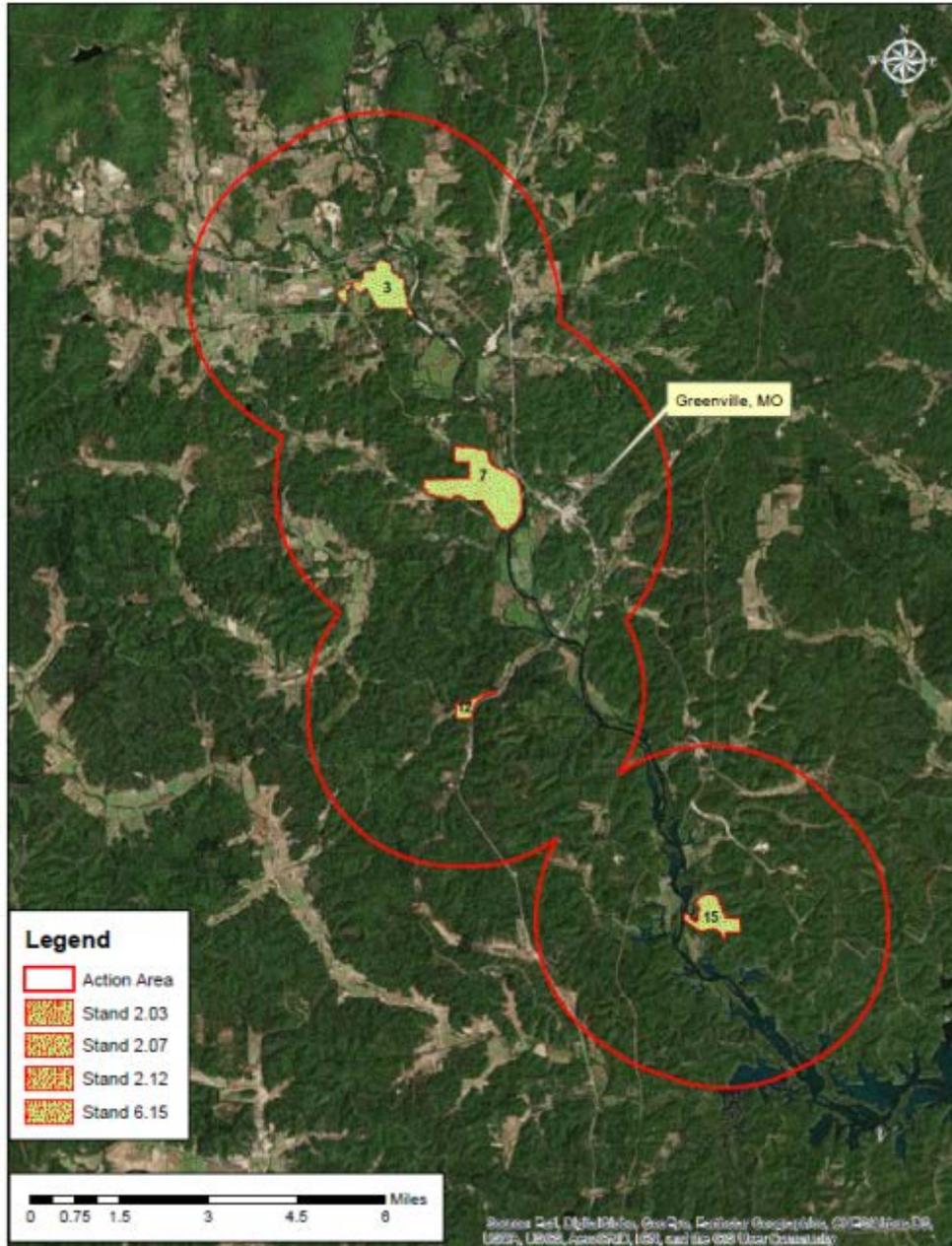


Figure 1. Action area for the Wappapello Lake TSI Management Strategies – Phase III.

## 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 either included or referenced 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.

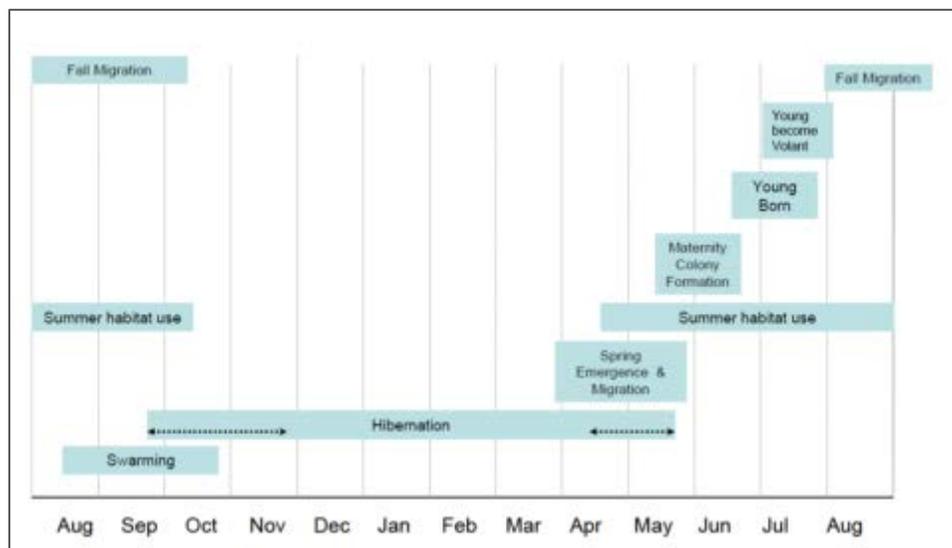
## Indiana bat

Portions of information regarding the Indiana bat are also presented in listing documents, the 1983 Recovery Plan for the Indiana Bat (USFWS 1983), the 2007 Indiana Bat Draft Recovery Plan (First Revision) (USFWS 2007), and are incorporated by reference.

### *Species Description and Life History*

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 dull pinkish-brown on the back but somewhat lighter on the chest and belly, and the ears and wing membranes do not contrast 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 and a long, pointed, symmetrical tragus.

Generally, Indiana bats hibernate from October through April (Hall 1962, LaVal and LaVal 1980), depending upon local weather conditions. The species' annual cycle is depicted in Figure 5. They hibernate in large, dense clusters, ranging from 300 bats per square foot to 484 bats per square foot (Clawson et al. 1980, Clawson, pers. obs. October 1996 in USFWS 2000). Upon arrival at hibernating caves in August-September, Indiana bats "swarm," a behavior in which large numbers of bats fly in and out of cave entrances from dusk to dawn. Relatively few bats roost in the caves during the day, but instead often 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.



**Figure 2. Indiana bat annual chronology. Taken from the Indiana Bat (*Myotis sodalis*) Draft Recovery Plan (First Revision)(USFWS 2007).**

Females emerge from hibernation ahead of males; most winter populations leave by early May. Some males spend the summer near hibernacula in Missouri (LaVal and LaVal 1980) and West

Virginia (Stihler, pers. obs. October 1996 *in* USFWS 2000). In spring when fat reserves and food supplies are low, migration is probably hazardous (Tuttle and Stevenson 1977). Consequently, mortality may be higher in the early spring, immediately following emergence.

Females may arrive in their summer habitats as early as April 15 in Illinois (Gardner et al. 1991, Brack 1979). During this early spring period, a number of roosts (e.g., small cavities) may be used temporarily, until a roost with larger numbers of bats is established. Humphrey et al. (1977) reported that Indiana bats first arrived at their maternity roost in early May in Indiana, with substantial numbers arriving in mid-May. Birth of young occurs in late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977) and 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). Female Indiana bats exhibit strong site fidelity and philopatry to summer roosting and foraging areas (Garner and Gardner 1992).

Trees in excess of 40.6 cm (16 inch (in)) diameter at breast height (dbh) with exfoliating bark are considered optimal for maternity colony roost sites, but trees in excess of 22.9 cm (9 in) dbh appear to provide suitable maternity roosting habitat (Romme et al. 1995). Cavities and crevices in trees may also be used for roosting. In Illinois, Gardner et al. (1991) found that forested stream corridors and impounded bodies of water were preferred foraging habitats for pregnant and lactating 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. By late September many females have entered hibernation, but males may continue swarming well into October, apparently in an attempt to breed with late arriving females.

Male Indiana bats may be found throughout the entire range of the species. Males roost singly or in small groups, except during brief summer visits to hibernacula. Males have been observed roosting in trees as small as 3 in dbh, but the average roost diameter for male Indiana bats is 13 in (USFWS 2007).

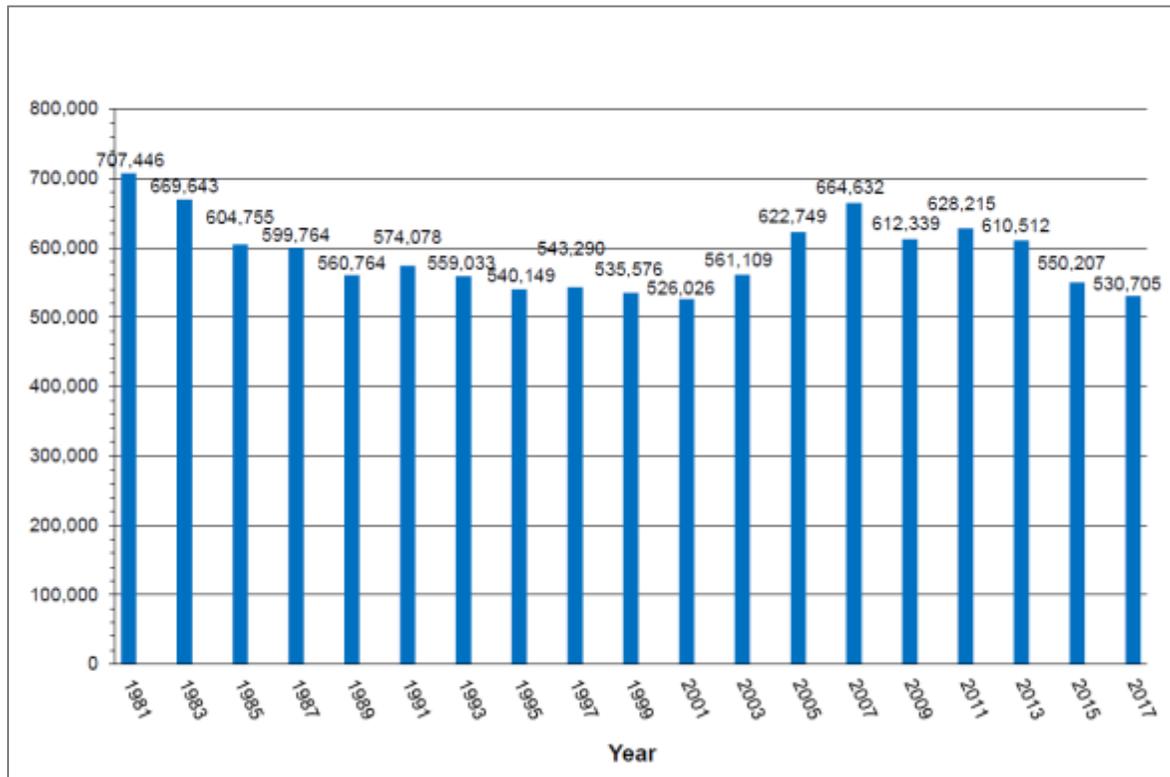
### *Diet and Foraging*

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. Bats forage at a height of approximately 2-30 m (6.5-98.4 ft) under riparian and floodplain trees (Humphrey et al. 1977). They forage between dusk and dawn and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects. Females in Illinois were found to forage most frequently in areas with canopy cover of greater than 80%, and typically utilize larger foraging ranges than males (Garner and Gardner 1992).

### Range and Population Dynamics

The historical summer range of the Indiana bat is thought to be similar to its current range. However, the bat has been locally extirpated due to fragmentation, loss of summer habitat, and the spread of White-nose syndrome (WNS) (see page below). The current species range includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida.

Based on censuses taken at all hibernacula, the total known Indiana bat population was estimated to number about 530,705 bats in 2017 (Figure 6). Population trend data showed a steady increase from 2001 to 2007, a drop in 2009, and another drop beginning in 2013.



**Figure 3. Indiana bat rangewide population estimates from 1981 – 2017<sup>1</sup>. Based on data analyzed by U.S. Fish Wildlife Service and accessible at: <https://www.fws.gov/midwest/endangered/mammals/inba/pdf/2017IBatPopEstimate5July2017.pdf>.**

<sup>1</sup> A previously unknown Indiana bat hibernaculum was discovered in Missouri in 2012. Based on first-hand accounts of very large clusters/numbers of hibernating bats at this site for several decades prior to its discovery by bat biologists, the Service decided to add the same number of bats as was found in 2013 to each previous biennium through 1981.

### *Status*

The Indiana bat was listed as an endangered species on March 11, 1967 (USDI 1967) under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U. S. C. 668aa(c)). Reasons for listing the species were summarized in the original recovery plan (USFWS 1983) and are: (1) declines in populations at major hibernacula due to human disturbance, (2) the largest known hibernating population at Pilot Knob Mine, Missouri continued to be threatened due to mine collapse, and (3) other hibernacula throughout the species range were not adequately protected.

Eleven caves and two mines in six states were listed as critical habitat on September 24, 1976 (USFWS 1976). These sites along, with other known hibernacula, were classified in the Indiana Bat Recovery Plan as Priority 1, containing at least 30,000 bats; Priority 2, containing 1,000 to 30,000; and Priority 3 with less than 1,000 bats (USFWS 1983).

In 2007, the USFWS recommended revising the criteria for priority 1 hibernacula to be a minimum of 10,000 bats vs. 30,000 and further advocated subdividing this classification into two subcategories, "A" and "B", depending on their recent populations sizes (USFWS 2007). Priority 1A hibernacula are those that have held 5,000 or more Indiana bats during one or more winters surveys conducted during the past 10 years. Priority 1B hibernacula are those that sheltered > 10,000 Indiana bats at some point in their past, but have consistently contained fewer than 5,000 bats over the past 10 years (USFWS 2007). Priority 2 hibernacula in the 2007 revised recovery plan have a current or observed population of 1,000 or greater but fewer than 10,000 Indiana bats (USFWS 2007). The USFWS also proposed that the range for Priority 3 hibernacula be 50 – 1,000 bats, and Priority 4 hibernacula with fewer than 50 bats (USFWS 2007).

The USFWS (2007) also proposed separate recovery units based on population discreteness, differences in population trends, and broad level differences in land-use and macrohabitats. There are currently four proposed recovery units for the Indiana bat: Ozark-Central, Midwest, Appalachian Mountains, and Northeast (USFWS 2007).

### *Reasons for Decline – Documented Causes*

Human-related factors have been documented as contributing to population declines in the past. These include:

Disturbance and vandalism - A major cause of Indiana bat decline has been human disturbance of hibernating bats during the decades of the 1960s through the 1980s. Bats enter hibernation with only enough fat reserves to last until spring. When a bat is aroused, as much as 68 days of fat supply is used in a single disturbance (Thomas et al. 1990). Human disturbance near hibernating Indiana bats can cause arousal (Humphrey 1978, Thomas 1995, Johnson et al. 1998). If this happens too often, the bats' fat reserves may be exhausted before spring emergence.

Active programs by State and Federal agencies have led to the acquisition and protection of a number of Indiana bat hibernacula. Of 127 caves/mines with populations >100 bats, 54 (43%) are in public ownership or control, and most of the 46 (36%) that are gated or fenced

are on public land. Although such conservation efforts have been successful in protecting Indiana bats from human disturbance, they have been insufficient in reversing the downward trend in many populations.

Improper cave gates and structures - Some hibernacula have been rendered unavailable to Indiana bats by the erection of solid gates in the entrances (Humphrey 1978). The exclusion of Indiana bats from caves and changes in air flow have caused major losses in some hibernating populations of Indiana bats in Indiana, Kentucky, and Missouri (USFWS 2007). Improperly constructed or engineered cave gates modified the climate of hibernacula and Indiana bats were unable to survive the winter because changes in air flow elevated temperatures that subsequently resulted in an increase in metabolic rate and a premature exhaustion of fat reserves (Richter et al. 1993).

Natural hazards - Indiana bats are subject to a number of natural hazards. River flooding in Bat Cave, Mammoth Cave National Park, drowned large numbers of Indiana bats (Hall 1962). Other cases of hibernacula being flooded have been recorded by Hall (1962) and DeBlase et al. (1965)(USFWS 2007). A case of internal cave flooding occurred when tree slash and debris were bulldozed into a sinkhole. The debris blocked the cave's rain water outlet and drowned an estimated 150 Indiana bats (USFWS 2007).

Another hazard exists because Indiana bats hibernate in cool portions of caves that tend to be near entrances, or where cold air is trapped. Some bats may freeze to death during severe winters (Humphrey 1978, Richter et al. 1993). Temperatures within maternity roosts can also affect Indiana bats. Development of young bats is directly affected by temperatures inside the roost (Tuttle 1975, Racey 1982). Humphrey et al. (1977) postulated that a cold summer delayed the recruitment of Indiana bats by 2.5 weeks and the completion of migration by 3 weeks when bats were exposed to freezing weather at a maternity colony. Such exposure could possibly affect mortality, autumn mating, or fat storage for winter (USFWS 2007).

#### *Reasons for Decline – Suspected Causes*

All causes of Indiana bat population declines have not yet been determined. Other factors suspected of contributing to declines include:

Microclimate effects - Changes in the microclimates of caves and mines may have contributed more to the decline in population levels of the Indiana bat than previously estimated (Tuttle, in lit. August 4, 1998). Entrances and internal passages essential to air flow may become larger, smaller, or closed altogether, with concomitant increases or decreases in air flow. Blockage of entry points, even those too small to be recognized can be extremely important in hibernacula that require chimney-effect air flow to function.

Land use practices - The Indiana bats' maternity range has changed dramatically since pre-settlement times (Schroeder 1981, Giessman et al. 1986, MacCleery 1992, Nigh et al. 1992). Most of the forest in the upper Midwest has been fragmented and fire has been suppressed. Native plant species have been replaced with exotics in large portions of the maternity range, and plant communities have become less diverse than occurred prior to settlement. It is not

known, however, how changes in plant diversity have impacted foraging opportunities or diet for the species. Additionally, numerous chemicals are applied to these intensely cropped areas and application of pesticides has been identified as a factor contributing to the decline of the species (USFWS 2007; see Chemical contamination below).

In the eastern U. S., the area of land covered by forest has been increasing in recent years (MacCleery 1992, Iverson 1994, Crocker et al. 2006). Whether or not this is beneficial to the Indiana bat is unknown. The age, composition, and size class distribution of the woodlands will have a bearing on their suitability as roosting and foraging habitat for the species outside the winter hibernation season. It is likely that the closing of forest canopies due to fire suppression and over stocked stands has been detrimental to the species because in addition to high quality roost trees, maternity colonies need some openness to the canopy for thermoregulation and to facilitate foraging (Romme et al. 1995).

Chemical contamination - Pesticides have been implicated in the declines of a number of insectivorous bats in North America (Mohr 1972, Reidinger 1972, Reidinger 1976, Clark and Prouty 1976, Clark et al. 1978, Geluso et al. 1976, Clark 1981). The effects of pesticides on Indiana bats have yet to be studied. McFarland (1998) studied two sympatric species; the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*M. septentrionalis*) as surrogates in northern Missouri and documented depressed levels of acetylcholinesterase, suggesting that bats there may be exposed to sublethal levels of organophosphate and/or carbamate insecticides applied to agricultural crops. McFarland (1998) also demonstrated that bats in northern Missouri are exposed to significant amounts of agricultural chemicals, especially those applied to corn. BHE Environmental, Inc. (1999) collected tissue and guano samples from five species of bats at Fort Leonard Wood, Missouri and documented the exposure of bats to p,p'-DDE, heptachlor epoxide, and dieldrin.

New Threats/Disease epidemics - White Nose Syndrome (WNS) - WNS was first documented in New York in February of 2006 and has since been confirmed in 19 states and 4 Canadian Provinces ([www.whitenosesyndrome.org/resources/map](http://www.whitenosesyndrome.org/resources/map)). It is currently unknown if WNS is the primary cause or a secondary indicator of another pathogen, but 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 (<http://whitenosesyndrome.org/>; [www.fws.gov](http://www.fws.gov)).

Overall mortality rates, primarily of little brown bats, have ranged from 90 to 100 percent in hibernacula in the northeastern United States ([www.whitenosesyndrome.org](http://www.whitenosesyndrome.org)). It is currently estimated that 5.7 to 6.7 million bats have died from WNS in infected regions ([www.whitenosesyndrome.org/about-white-nose-syndrome](http://www.whitenosesyndrome.org/about-white-nose-syndrome)). Apparent losses of 685 Indiana bats in Hailes Cave and all but 124 of 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.

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 Albany and Schoharie Counties, 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. The syndrome has continued to spread rapidly and as of September 2014, bats with WNS were confirmed in 25 states and five Canadian provinces ([http://www.nwhc.usgs.gov/disease\\_information/white-nose\\_syndrome/index.jsp](http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/index.jsp)). 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.

In response to many of these threats and in accordance with Federal law, a revised recovery plan has been drafted for the species that outlines strategies and actions believed to be necessary for the recovery of a species (USFWS 2007). In sum, the objectives of the Recovery Plan are to: (1) protect hibernacula; (2) maintain, protect, and restore summer maternity habitat; and (3) monitor population trends through winter censuses.

At the time the revised recovery plan was drafted in 2007, the causative agent for WNS had not yet been discovered 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](http://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 to slow 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 threatened with extinction.

### **III. ENVIRONMENTAL BASELINE**

The purpose of the environmental baseline is to describe past and ongoing human and natural factors that have contributed to the current status of the species and its habitat in the project vicinity. Range-wide factors affecting the Indiana bat include those listed previously under *Reasons for Decline – Documented Causes* and *Reasons for Decline – Suspected Causes*. Other factors having the potential to adversely affect roosting habitat and foraging of both species include: (1) forest clearing by private industry within the summer range in Missouri, (2) woodlot management that fails to provide adequate roosting and foraging habitat, and (3) other private and municipal land management activities that affect the structure and abundance of forest resources in Missouri.

## Status of the Species within the Action Area

As described previously, the action area for the Wappapello TSI Management Strategies – Phase III includes the treatment areas plus a 4.02 km (2.5 mi)<sup>1</sup> radius around the treatment areas. Thus, the total action area comprises a total of 61,588 acres.

Though the majority of maternity roosting habitat for Indiana bats exists in north Missouri, recent surveys have revealed that southeast Missouri also provides summer and maternity habitat for the species, especially along the St. Francis River. Much of the remaining forested land cover classes in south and southeast Missouri is overstocked due to lack of management. This has led to a degradation of overall forest health in even-aged stands, resulting in an increase in diseased and dying trees that have not reached maturity, undesirable tree species regeneration, and habitat conditions that are inappropriate or suboptimal for the Indiana bat.

Over the course of several years, multiple mist net and acoustic surveys have been conducted across USACE lands at Lake Wappapello and adjacent U.S. Forest Service lands within the Mark Twain National Forest system. Within the timber stands proposed for treatment, no Indiana bats have been captured and no maternity roosts have been located. However Indiana bats have been documented at multiple sites within the action area (Table 2, Figure 3) and nearly all of Compartment 2 and the northern half of compartment 6 are within known maternity habitat for the species.

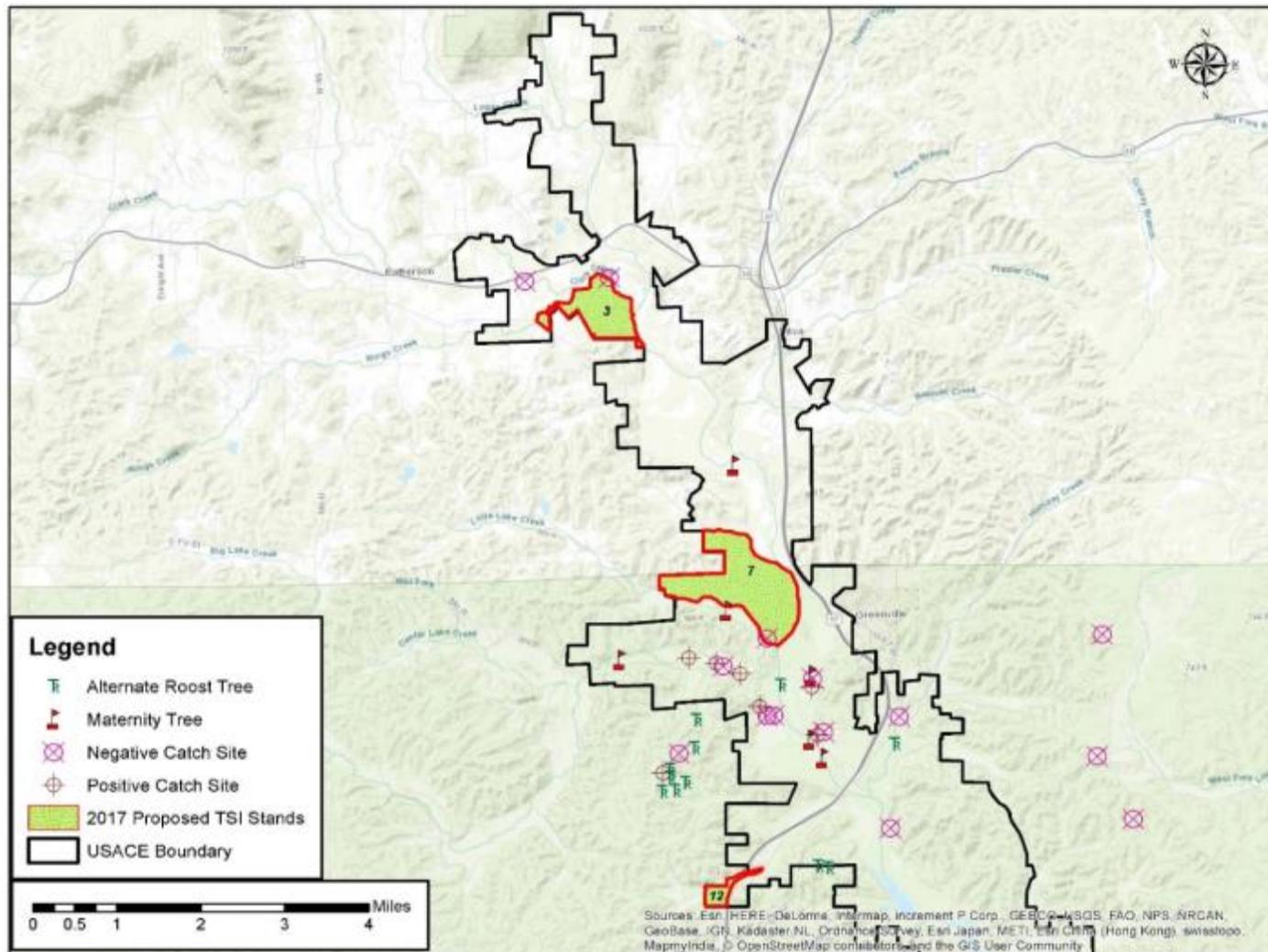
Due to the proximity to known locations and because potentially suitable roosting, foraging, drinking, and stopover/migration habitat is present within each stand, each timber stand will be treated as though Indiana bats are likely present. No known caves or hibernacula occur on USACE lands at Lake Wappapello.

**Table 1. Indiana bat survey results in proximity to proposed TSI treatment stands.**

Compartment and Stand	Survey Details
Compartment 2, Stand 3	Indiana bat maternity colony located approximately 4 miles south of stand 3 during the 2016 summer survey season
Compartment 6, Stand 7	Indiana bat maternity colony located approximately 1.5 miles southwest of stand 7 during the 2016 summer survey season
Compartment 6, Stand 12	Indiana bat maternity colony located approximately 3.1 miles northwest of stand 12 during the 2016 summer survey season
Compartment 6, Stand 15	Indiana bat maternity colony located approximately 6.5 miles south of stand 15 during the 2012 summer survey season near Asher Creek

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<sup>1</sup> The 4.02 km (2.5 mi) radius represents what the Service considers is the average home range of an Indiana bat maternity colony.



**Figure 4. Northern portion of Wappapello Lake Indiana bat survey results 2004-2016, shown in proximity to 2017 TSI stands in Compartment 2. Map taken from the July 2017 biological assessment provided by the USACE.**

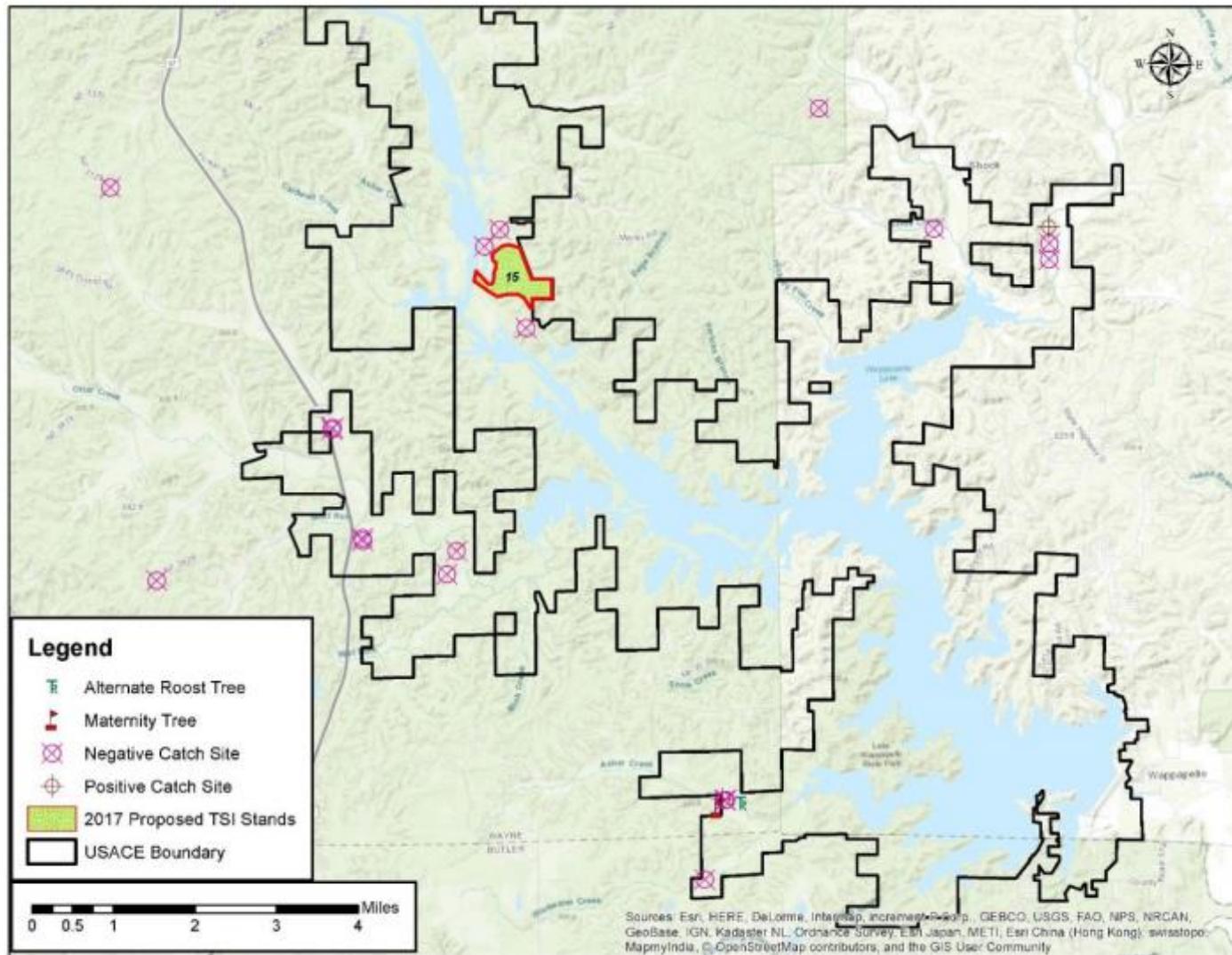


Figure 5. Southern portion of Wappapello Lake Indiana bat survey results 2004-2016, shown in proximity to the 2017 TSI stands in Compartment 6. Map taken from the July 2017 biological assessment provided by the USACE.

## **Factors Affecting the Species Environment within and adjacent to the Action Area**

Factors affecting the Indiana bat environment within and adjacent to the action area are expected to be the same. Landownership in the action area is approximately 25% private and 75% public, with the public portion being owned and managed by the USACE, USFS Mark Twain National Forest, and Missouri Department of Conservation (MDC). Current land-use in the action area varies. Timber production and forest management activities are implemented on USFS and MDC-managed lands. There are limited agricultural areas with row crops and grazing. Ecosystem restoration and recreational opportunities occur on portions of all public lands in the action area.

## **IV. EFFECTS OF THE ACTION**

This section includes an analysis of the direct and indirect effects of the proposed action and associated interrelated and interdependent activities on the Indiana bat and all areas potentially used by the species. The proposed action and associated activities are discussed below in relation to the factors considered. Additionally, the expected response of the species to the listed actions is identified, where applicable.

### **Proposed Action**

The proposed TSI management strategies through single tree selection would be implemented on approximately 410 acres of forest adjacent to Wappapello Lake. Indiana bats have been captured within Compartment 2 and near Compartment 6, and several known maternity trees have been identified located within 5 miles of the stands. Although no Indiana bats have been captured within the other stands, forest inventories indicate that suitable roosting habitat is present. Based on the presence of suitable roosting habitat and proximity to known maternity colonies (Table 2), it is possible that some trees may be utilized by resident maternity colonies.

*Direct Injury and/or Mortality* - Tree felling will be conducted outside of the maternity season for the Indiana bat, to the extent practicable, to avoid direct take as a result of this action. However, because of unfavorable weather conditions and the reluctance to impact forest soils if undertaken during cold winter months, some activities may take place during the active season. Permanent impacts could include direct mortality of Indiana bats if an occupied roost tree is felled. However, the USACE has proposed in the above conservation measures to retain all trees that could provide roosting habitat to minimize the likelihood of mortality or injury of individuals. Trees that will be favored for retention include all wolf trees, dead trees, split trees, trees that have cavities, and trees with exfoliating bark.

*Loss of Roosting and Foraging Habitat* - 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 bat 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). Additionally, forest management actions implemented in unmanaged forest habitat will serve to benefit Indiana bats in the long-term by improving foraging and roosting opportunities.

*Disturbance by Construction Activities* – Noise disturbance created by construction activities occurring in areas adjacent to suitable roost trees may disturb roosting Indiana bats. However, maximizing operations within these areas during the hibernation season should minimize the amount of disturbance to which roosting bats are exposed.

*Amount of Individuals Affected* – Based on results of surveys conducted within the treatment stands and surrounding areas (i.e., Mark Twain National Forest), we believe that one Indiana bat colony, at most, could occur within the Lake Wappapello compartments. Because the average maternity colony size for the Indiana bat is estimated to be 50 to 80 adult females (USFWS 2007), it is possible that a maximum of 80 individuals could be harmed or harassed if a roosting tree is inadvertently felled or if construction activities adjacent to a roosting tree disturb individuals. However, we do not anticipate that all individuals in a colony would be impacted; thus the number of reproductive females potentially impacted would likely be less than 80. But because it is possible that males and non-reproductive females (not part of the colony) could also be affected, we consider 80 to be an appropriate estimate of the maximum number of individuals potentially adversely affected by project activities.

The proposed activities are intended to improve forest health in the future and improve foraging and roosting opportunities for Indiana bats and other forest wildlife. Some of the impacts would be temporary, such as loss of a roost tree. However, senescence of trees within the stands would provide a long-term supply of potential roost trees. Dead trees and other trees with qualities that provide roosting opportunities will be left standing to provide roosting opportunities in the short-term. The proposed TSI practices that include single tree selection will likely ensure the availability of quality roosting habitat within the project area.

## **Interrelated Activities, Interdependent Activities, and Indirect Effects**

### *Interrelated Activities*

Interrelated activities are those that are part of a larger action and depend on the larger action for their justification. For this consultation, interrelated activities would include the transport of timber using haul roads and possible establishment of landings. Haul roads will consist of ridgetops, agricultural fields, and preexisting roads (agricultural, county, USACE, etc.). Landings may be established on ridge tops and flat areas suitable for access and for minimizing soil disturbance. Landings would be established in locations in which removal of potential roost trees is not necessary, and most landings would be sited in naturally open areas or where prior timber harvest has occurred. We do not anticipate impacts to the Indiana bat.

### *Indirect Effects*

Indirect effects to listed species are those effects that are caused by or will result from the proposed action and are later in time but are still reasonably certain to occur. Indirect effects may include other Federal activities that have not undergone Section 7 consultation but will result from the action under consideration as well as non-Federal actions that might reasonably be expected to occur in the future as a result of the subject action. In this consultation, the Service considered the potential for such future activities on the action area and determined that other additional Federal activities in the action area are reasonably certain to occur. These actions include treatment of additional stands with TSI and prescribed burning. It is also possible that actions by individual landowners, such as timber harvest, could occur in the action area.

We expect that potentially occupied trees may be cut to preserve human health and safety while Indiana bats are present in the area. In addition, tree clearing and general silviculture practices as part of forest management or landscaping scheduled during the hibernation period could also result in the further removal of roost trees, rendering them unavailable to pregnant bats that exhibit roosting area and/or roost tree fidelity following migration in the spring. However, decreases in the long-term reproductive success and viability of a maternity colony in the area are unlikely because of the remaining habitat on the surrounding landscape. Additionally, the anticipated benefits of the conservation measures proposed by the USACE will help reduce impacts to individual Indiana bats and provide roosting habitat.

## **V. CUMULATIVE EFFECTS**

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

To date, much of the private land interspersed among public lands in the action area have undergone intensive timber harvest. It is likely that various silvicultural practices, including timber harvest will occur on public and private land within the action area.

Wayne County was quarantined for emerald ash borer (*Agrilus planipennis*) in 2008. Quarantines are in place to prevent infested ash firewood, logs or nursery trees from being transported and starting new infestations. Ash (*Fraxinus* spp.) logs that are cut to go to market must be taken to a certified mill. Other methods that are implemented on State, local, and private land include phloem reduction through the slash and burn of ash trees within the highly infested area to remove the availability of the desired host. Because ash trees have characteristics that make them preferred roosting sites for Indiana bat (USFWS 2007), it is anticipated that potential Indiana bat habitat will be eliminated on private and public land in attempts to prevent the spread of the borer.

## VI. CONCLUSION

After reviewing the current status of the Indiana bat, 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.

Although as many as 80 individual Indiana bats will likely be harmed by the action, we do not anticipate population-level impacts. This determination is based on the following considerations: 1) the proposed action will impact at most 0.03% of the Ozark-Central Recovery Unit<sup>1</sup>; 2) the proposed action area is small relative to the species range<sup>2</sup>; 3) the proposed action will only affect a small portion of the action area and will not substantially alter the overall availability of Indiana bat habitat within the action area; 4) while the proposed action may result in direct effects through loss of occupied roost trees, the potential for this has been minimized as a result of the conservation measures; and 5) the proposed action will improve forest health in the future and improve foraging and roosting opportunities for Indiana bats. 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 regulation pursuant to section 4(d) of the Act prohibits the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the USACE 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 (1) fails to assume and implement the terms and conditions, or (2) fails to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit, the protective coverage of Section 7(o)(2)

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<sup>1</sup> Based on an estimated population size of 271,965 individuals for the Ozark-Central Recovery Unit (Based on data analyzed by U.S. Fish Wildlife Service, Aug. 2017 and accessible at: <https://www.fws.gov/midwest/endangered/mammals/inba/pdf/2017IBatPopEstimate5July2017.pdf>).

<sup>2</sup> The total range wide amount of suitable habitat is unknown. However, the amount of forested habitat in Wayne County, Missouri has been estimated using Forestry Inventory Data (Theresa Davidson, U.S. Forest Service, pers. comm. Jan. 30, 2015) to be approximately 400,000 acres. Assuming that all forested habitat is suitable for the species, the 627 treatment area of the proposed project will constitute an estimated 0.16% of available habitat in Wayne County.

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).

**Extent of Take Anticipated**

Indiana bat

As described under **EFFECTS OF THE ACTION**, incidental take of the Indiana bat could occur if individuals are present or utilize one of the areas proposed for timber management. However, the Service anticipates that actual incidental take of the Indiana bat as a result of the projects 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 stands proposed for treatment. 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 management activities begin, it would be impossible to know if a roosting Indiana bat is present in an area proposed for timber management. 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. As detailed in Table 2 below, the Service anticipates that no more than 410 acres of potential Indiana bat habitat will be disturbed as a result of project activities. We expect take to occur within in the period of one year based on the anticipated work schedule of one year to complete activities in all four stands.

**Table 2. Estimated acreage affected by Timber Stand Improvement. Lake Wappapello, Wayne County, Missouri.**

<b>Location</b>	<b>Indiana bat incidental take (acres)</b>
Compartment 2, Stand 3	80
Compartment 2, Stand 7	160
Compartment 2, Stand 12	20
Compartment 6, Stand 15	150
<b>Total</b>	<b>410</b>

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 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**

In the accompanying Biological Opinion, the Service determines that this level of expected take is not likely to result in jeopardy to the species.

## **Reasonable and Prudent Measures**

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

1. Avoid direct mortality of females and non-volant juveniles in maternity roosts;
2. Locate, maintain, and monitor known occupied maternity trees;
3. Avoid direct mortality of individuals that use non-maternity roosts for shelter;
4. Ensure the presence of an adequate short-term supply of roost trees and maintain a continuous, long-term supply of high quality roost trees; and
5. Implement conservation measures identified in the Biological Assessment.

## **Terms and Conditions**

In order to be exempt from the prohibitions of Section 9 of the Act, the USACE must comply with the following terms and conditions. These terms and conditions are non-discretionary.

1. Avoid direct mortality of females and non-volant juveniles in maternity roosts
  - a. All potential maternity roost trees will be retained. Tree characteristics conducive to maternity roosts by Indiana bats will be visually assessed by a trained resource professional. A determination will be made regarding whether or not trees provide maternity roosting opportunities. All trees that provide maternity roosting habitat will not be felled and removed.
  - b. If removal of a potential maternity roost tree larger than 16" dbh is necessary outside of the hibernation period to protect human health and safety, the Service shall be notified, and reasonable effort shall be made to determine if the tree is occupied by one or more Indiana bats. If the tree is determined to be occupied, further coordination with the Service is required.
2. Locate, maintain, and monitor known occupied maternity trees and resident Indiana bat populations
  - a. Presence and use of the project area by Indiana bats will be determined through surveys (capture and radio telemetry) and location of primary and alternate maternity roost trees in the project area will be determined, if applicable.
  - b. Prevent the cutting or felling and maintain occupied/active maternity roost trees until they naturally fall to the ground.

- c. Continue Indiana bat monitoring. The spatial extent of monitoring and level of survey effort will be outlined in a comprehensive Indiana bat monitoring plan developed by the USACE in coordination with the Service.
  - d. In order to determine the location of occupied roost trees, radio transmitters should be placed on the first female Indiana bat captured within each compartment during mist-netting surveys. Procedures should follow permit conditions outlined in approved Section 10 (a)(1)(A) Federal permits and these activities should be reported within 24 hours to the Service's Missouri Ecological Services Field Office.
  - e. Monitoring results shall be submitted to the Missouri Ecological Services Field Office of the Service by December 31 of the year in which the monitoring event occurred. Reports must contain:
    - i. Any management or habitat manipulations that have occurred to date
    - ii. The results of the mist netting survey, including number, sex, age (mature or juvenile) and reproductive status of all bats captured, including Indiana bats, if any are captured.
    - iii. Whether or not dead Indiana bats were found in the project area. Should one or more Indiana bats be encountered during the course of the project, the Missouri Ecological Services Field Office must be notified upon the discovery, and the number, age, sex, and reproductive status of the bat(s) is to be reported.
  - f. If any Indiana bats are found dead or injured following the necessary removal of a tree during the maternity season, the following protocols are requested:
    - i. Contact Shauna Marquardt of our office at [shauna\\_marquardt@fws.gov](mailto:shauna_marquardt@fws.gov) (573-234-2132, ext. 174) for deposition of specimens. She will contact appropriate individuals regarding final deposition and use of any specimen pending condition of the recovered carcass.
    - ii. Specimens should be frozen in a plastic bag and include date and location with latitude and longitude coordinates.
    - iii. Contact USFWS law enforcement in St. Peters Missouri: 636-441-1909
    - iv. Provide a report on the circumstances surrounding the discovery and incidental taking.
3. To the maximum extent possible and logistically feasible, provide an adequate short-term supply of high quality roost trees and maintain a continuous, long-term supply of high quality roost trees
- a. Current baseline habitat (8 snags per acre) conditions will be enhanced in order to provide adequate short-term roosting opportunities. This will be accomplished through the natural recruitment of snags as a result of timber harvest.

## REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the BA submitted by the USACE for the Wappapello Lake TSI management strategies 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 agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the monitoring period, the level of incidental take described above is exceeded, reinitiation of consultation and review of the reasonable and prudent measures is required. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

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Theresa Davidson, U.S. Forest Service, 2015

## **APPENDIX A: Compartment and Stand Maps**

# Stand Location Compartment 2, Stand 3, 7, 12

