# Biological Opinion

# Kentucky Field Office's Participation in Conservation Memoranda of Agreement for the Indiana Bat and/or Northern Long-eared Bat

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# Executive Summary

The U.S. Fish and Wildlife Service, Kentucky Field Office (KFO) proposes to participate in an indefinite number of voluntary Conservation Memoranda of Agreement (CMOA) with federal and non-federal entities that would provide recovery-focused conservation benefits for Indiana and northern long-eared bats associated with the removal of forested habitat that is suitable for these species throughout the Action Area over a 5-year period. The Action Area includes all lands within the boundaries of the Commonwealth of Kentucky and those portions of Missouri, Illinois, Indiana, Ohio, West Virginia, Virginia and Tennessee that occur within 20 miles of the Kentucky state line.

The habitat removal associated with CMOA projects is limited to 100 acres per individual project and 10,000 acres of habitat per species (with no overlap in species coverage, a maximum of 20,000 acres). This habitat removal would result in adverse effects to Indiana and northern long-eared bats due to the potential for death, injury, and/or disruption of normal behavior patterns from the destruction, modification, and/or fragmentation of forested habitats that are known to support, or may support, these species. Through the CMOA process, project proponents would provide mitigation to compensate for these habitat impacts, resulting in a net-conservation benefit to these species.

The proposed CMOA program provides a voluntary option to Endangered Species Act (ESA) section 7(a)(2) consultations for federal agencies who must ensure that their actions do not jeopardize Indiana bats or northern long-eared bats, and must obtain an exemption for taking of these species that is incidental to those actions. Likewise, it provides a voluntary option to ESA section 10(a)(1)(B) permits for non-federal entities who must obtain an exception for taking that is incidental to their actions. Projects that may qualify for CMOAs cannot have substantial or unpredictable impacts based on project-specific details (e.g., location, timing, etc.), to the two species of bats without additional analysis and project-specific impact avoidance and minimization measures. This BO evaluates the adverse effects of CMOA projects and the beneficial effects of compensatory mitigation that project proponents would implement or fund by participating in a CMOA. The KFO does not authorize, fund, or carry out a project that is the subject of a CMOA, but does decide whether to enter a CMOA with a project proponent as an optional pathway for the proponent's compliance with the ESA, which this BO addresses.

The KFO determined the proposed action may affect, and is likely to adversely affect, the Indiana bat and the northern long-eared bat, and requested formal consultation. The Southeast Regional Office, serving as the intra-Service consulting office, has determined in this Biological Opinion (BO) that the proposed action will not jeopardize the continued existence of the Indiana bat or the northern long-eared bat, and will not adversely modify designated critical habitat for the Indiana bat. Critical habitat for the northern long-eared bat is not designated or proposed. The BO includes an Incidental Take Statement that exempts taking of the two bat species that is incidental to the proposed action from the prohibitions against taking listed species.

# Consultation History

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|---|---|
| October 2014 | The U.S. Fish and Wildlife Service's (Service) Kentucky Field Office (KFO) provides early drafts of the Conservation Strategy and Biological Opinion to the U.S. Fish and Wildlife Service's Southeast Regional Office (RO). |
| November 2014 | RO provides comments and recommendations to the KFO on the draft Conservation Strategy. |
| January 14, 2015 | RO provides comments on draft Biological Opinion and requests KFO convert the Biological Opinion into a Biological Assessment. |
| March 18, 2015 | The KFO provides a Biological Assessment of the proposed action and requests initiation of formal consultation with the RO. |
| March – April 2015 | KFO and RO address outstanding issues associated with the Conservation Strategy and Biological Opinion. |

# Biological Opinion

A Biological Opinion (BO) is the document that states the opinion of the U.S. Fish and Wildlife Service (Service) as to whether a federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat (50 CFR §402.02). "To jeopardize the continued existence of a listed species" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of the species (50 CFR §402.02).

This BO addresses the effects of the Service's Kentucky Field Office (KFO) proposal to participate in Conservation Memoranda of Agreement for the federally-endangered Indiana bat (*Myotis sodalis*) and the threatened northern long-eared bat (*Myotis septentrionalis*) (the Action). For this intra-Service consultation, the KFO is the federal action agency, and the Service's Southeastern Regional Office (RO) is the consulting office.

The Service has designated critical habitat for the Indiana bat, but the Action excludes activities located within critical habitat. Critical habitat has not been designated or proposed for the northern long-eared bat. Therefore, this BO does not address effects to critical habitat.

## 1 Proposed Action

The Action is the KFO's proposed participation in an indefinite number of voluntary Conservation Memoranda of Agreement (CMOAs) with Federal and non-Federal entities for projects that may affect Indiana and/or northern long-eared bats. These CMOAs would provide recovery-focused conservation benefits for Indiana and northern long-eared bats as mitigation for the removal of up to 10,000 acres of forested habitat (species' occupancy is either known or potential) for each species. With no overlap in species coverage, which is unlikely, CMOAs could cover a maximum of 20,000 acres of forested habitat removal throughout the Commonwealth of Kentucky and portions of adjacent states (Missouri, Illinois, Indiana, Ohio, West Virginia, Virginia, and Tennessee) that are within 20 miles of the Kentucky border. CMOAs are a primary mechanism for implementing the KFO's "Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky" (Strategy).

The proposed CMOA program provides a voluntary option to section 7(a)(2) consultations for federal agencies who must ensure that their actions do not jeopardize Indiana bats or northern long-eared bats, and must obtain an exemption for taking of these species that is incidental to those actions. Likewise, it provides a voluntary option to section 10(a)(1)(B) permits for non-federal entities who must obtain an exception for taking that is incidental to their actions. The KFO's biological assessment (BA) for the proposed CMOA program describes the characteristics of projects that may qualify for CMOAs, which are limited to forested habitat removal of a maximum extent (per project and for the program as a whole) and may not result in substantial or unpredictable impacts to the two species of bats, based on project-specific details

(e.g., location, timing, etc.), without additional analysis and project-specific impact avoidance and minimization measures. The BA describes the adverse effects of CMOA projects and the beneficial effects of compensatory mitigation that project proponents would implement or fund by participating in a CMOA. The KFO does not authorize, fund, or carry out a project that is the subject of a CMOA, but does decide whether to enter a CMOA with a project proponent as an optional pathway for the proponent's compliance with the ESA, which this BO addresses.

## 1.1 Action Area

"Action area" is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area for this consultation includes all lands within the geo-political boundaries of the Commonwealth of Kentucky and those portions of Missouri, Illinois, Indiana, Ohio, West Virginia, Virginia, and Tennessee that occur within 20 miles of the Kentucky state line (the Action Area). This Action Area corresponds with the scope of the Strategy and recognizes that projects associated with CMOAs: (a) are likely to occur at scattered and undeterminable locations across the Commonwealth; (b) may cross into adjacent states; and (c) will vary in size and distribution on the landscape.

An analysis of land cover within Kentucky and within the Action Area using the 2011 National Land Cover Database supports applying a description of Kentucky to the entire Action Area, as those portions of adjacent states included in the Action Area are very similar to the adjoining portion(s) of Kentucky. A more detailed explanation of these similarities is provided in the KFO's BA for the Action, which is hereby incorporated by reference.

Land use in Kentucky varies across the state and includes: agricultural farmland, livestock farmland, forest, streams and wetlands, residential development, industrial development, natural resource mines, infrastructure construction, urban development, and others. Today, much of Kentucky's natural habitat has been altered and continues to be altered. However, approximately 8 percent (1,950,541 acres) of Kentucky's land is in public ownership, much of that providing important conservation values for fish and wildlife (KDFWR 2013). The U.S. Forest Service has the largest public land holding in Kentucky, with the U.S. Army Corps of Engineers and the Commonwealth of Kentucky following in second and third, respectively. Other significant public land ownerships lie with the National Park Service, U.S. Fish and Wildlife Service, and U.S. Military reservations (KDFWR 2013). There are also several non-governmental organizations (NGOs) actively preserving and conserving biologically important lands within the Commonwealth. The lands in conservation ownership by these NGOs are included in the 92 percent of Kentucky which remains privately owned and play an important role by providing natural and semi-natural habitats to support wildlife diversity.

A 2010 Forest Inventory and Analysis published by the U.S. Forest Service (Oswalt 2012) reported that 12.4 million acres of Kentucky's land base is forestland. Kentucky's forests are most heavily concentrated in the eastern third of the state with the remaining 50 percent distributed across central and western Kentucky. The predominant forest type is oak-hickory, which constitutes 75 percent of the total forestland acreage (Oswalt 2012). The Kentucky Division of Forestry has identified forest loss and fragmentation as key threats to Kentucky's

forests (KDF 2010). Forest loss and fragmentation have significant impacts on forest-dwelling wildlife, including Indiana and northern long-eared bats.

## 1.2 Description of the Proposed Action

The following sections are summarized from the BA; please refer to the BA for a more information.

### 1.2.1 Conservation Strategy

To implement the proposed process, the KFO has developed a document, titled "Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky" (Strategy), which becomes effective as of the signature date of this BO. This Strategy will supersede the January 2011 "Indiana Bat Mitigation Guidance for the Commonwealth of Kentucky" and is included as an Appendix to the BA.

The Strategy is available for voluntary use by Federal agencies and non-Federal entities and identifies the compensatory mitigation measures that project proponents may implement or fund under a CMOA framework to assist in the conservation and/or recovery of Indiana and/or northern long-eared bats within the Action Area. The measures include: (a) protect known and previously unprotected Indiana and/or northern long-eared bat habitat with a demonstrated significance to either or both species; (b) contribute funds to the Imperiled Bat Conservation Fund (IBCF) sufficient to achieve identified mitigation needs if other measures are impractical or have limited value to Indiana and northern long-eared bat conservation and/or recovery; and (c) other activities that provide a tangible conservation benefit to forest-dwelling bats proposed to the KFO for a case-by-case evaluation.

### 1.2.2 Conservation Memoranda of Agreement

In executing a CMOA, the KFO will ensure proper implementation of the Strategy. While all CMOAs will outline each cooperator's (i.e., the KFO and the project proponent) commitments and responsibilities under the CMOA, the provisions of each CMOA will vary due to a variety of factors. Within these provisions, the KFO may choose to establish a process for either increasing or decreasing the mitigation ratios set forth in the Strategy. The KFO will ensure that any deviation is appropriate for the impacts proposed and does not undermine the goals of the Strategy. The KFO will justify and document each deviation in the CMOA or in a memo to the project file. Execution of a CMOA for projects with adverse effects in a neighboring state will require the advance, written approval of the Service Field Office(s) involved.

CMOAs will be both programmatic and project-specific in nature. Programmatic CMOAs will describe routine or reoccurring project types that typically include the same or similar types of potential adverse effects to Indiana and northern long-eared bats. As such, it is possible to accurately quantify potential adverse effects to Indiana and northern long-eared bat summer habitat that can result from these project-specific impacts on an acreage basis. Therefore, the KFO anticipates that programmatic CMOAs can streamline routine or reoccurring projects and provide significant benefits to Indiana and/or northern long-eared bats by ensuring that potential

impacts are quantified and conservation and/or recovery benefits are provided. Programmatic CMOAs may also be developed for non-linear projects where there is sufficient basis to do so, such as phased development clearing, mining, or other projects where blocks of habitat are expected to be impacted according to a schedule and can be accurately quantified.

Project-specific CMOAs will be used for projects that are not routine or reoccurring (i.e., one-time impacts) where the potential adverse effects to Indiana and/or northern long-eared bats can be quantified. As of August 1, 2014, the KFO had entered into 325 project-specific CMOAs (including several modifications) and 3 programmatic CMOAs exempting the incidental take associated with the removal/alteration of 3,811 acres of forest habitat that occurred over an approximately 5-year period. The currently proposed CMOA process updates that process for Indiana bats and incorporates the northern long-eared bat as a second covered species.

The KFO proposes to enter into CMOAs based on the Strategy with the following limitations:

1. Projects implemented under these CMOAs will impact no more than 10,000 acres (not to exceed 2,000 acres annually) of known and/or potential Indiana bat habitat.
2. Projects implemented under these CMOAs will impact no more than 10,000 acres (not to exceed 2,000 acres annually) of known and/or potential northern long-eared bat habitat.
3. Agreement periods will not exceed 5 years or will end on or before April 30, 2020, whichever occurs first.

At that time, the KFO will re-initiate formal consultation on implementation of the CMOAs and Strategy to ensure that their continued use will not jeopardize the continued existence of the species or adversely modify its designated critical habitat. The KFO will also re-evaluate the effectiveness of the Action, including the Strategy, to determine if the anticipated conservation and/or recovery benefits for Indiana and northern long-eared bats were achieved. If these evaluations determine that: (a) the continued use of CMOAs and implementation of the Strategy will not jeopardize the species or result in the adverse modification of designated critical habitat; and (b) the implementation of the CMOAs and Strategy has achieved the expected conservation and/or recovery benefits, the KFO may elect to continue use of CMOAs and the Strategy. If the KFO determines that the Strategy has not achieved the anticipated recovery-focused conservation benefits, the KFO may terminate its use or modify the process to achieve those benefits.

### 1.2.3 Covered Activities

The types of impacts to Indiana and northern long-eared bats that are addressed in this BO and covered by the CMOAs, are limited to those adverse effects caused by the removal of forested habitats. Projects with additional types of impacts to either species will require additional coordination with the KFO to ensure compliance with the ESA.

Forested habitat losses covered by these CMOAs may be permanent or temporary. They may occur while bats are likely to be present (occupied) or during the hibernation period when bats are not expected to be present (unoccupied). Impacts may occur in areas where Indiana and/or northern long-eared bats have been documented (known habitat) or where the presence of one or both of these species is assumed (potential habitat). Further, known habitats for either species

may include fall/spring swarming habitats around known hibernacula, and known summer habitats. All suitable habitats are considered to at least have the potential for both summer and winter (fall/spring swarming) uses unless probable absence of the species for that use has been demonstrated (e.g., through surveys).

To minimize impacts to these species during their most sensitive life stages, additional coordination (which may include additional restrictions) between the KFO and the CMOA cooperator is required when proposed activity would adversely affect known or potential maternity summer habitat while pups are non-volant (June 1 – July 31) and during the spring staging period (April 1–15) for sensitive portions of known swarming habitats.

For additional information on habitat types affected under CMOAs please refer to the Explanation of Terms section and Appendix B of the Strategy. Adverse effects to designated critical habitat for the Indiana bat, which is comprised entirely of known hibernacula, are not part of the Action, and are not addressed in this BO. Critical habitat has not been proposed for the northern long-eared bat.

### 1.2.4 Conservation Benefits

As described in the Strategy, the KFO has identified conservation goals for Indiana and northern long-eared bats based on identified conservation and/or recovery measures for these species. Projects covered under these CMOAs will include mitigation for their impacts to one or both of these species. However, this mitigation will exceed (at a programmatic scale) what is needed to compensate for impacts to the species, yielding a net conservation benefit or gain. Conservation benefits as well as impacts are generally tracked by acres and type (e.g., swarming, maternity, etc.) of habitat as it is the loss of habitat that drives the adverse effects evaluated in this BO.

Conservation benefits may be achieved directly through a CMOA (actions implemented by the project proponent) or indirectly through the IBCF. Regardless of the mechanism, all conservation benefits will be aligned with the goals identified in the Strategy. These goals have been established to maximize the benefits to the species by targeting actions that will help protect and manage these species during their most sensitive life-stages.

# 2 Indiana Bat

The following sections are summarized from the BA; please refer to the BA for a more information.

## 2.1 Status of the Species/Critical Habitat

The Indiana bat was listed as an endangered species on March 11, 1967 (Federal Register 32[48]:4001), under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). The ESA subsequently extended full legal protection from unauthorized take to the species. Critical habitat was designated for the species on September 24, 1976 (41 FR

14914). Thirteen hibernacula, including 11 caves and 2 mines in six states, were listed as critical habitat.

The Service published a recovery plan (USFWS 1983) that outlined recovery actions. A revised draft recovery plan was noticed in the Federal Register for public review and comment on April 16, 2007 (USFWS 2007), but has not yet been finalized. The Service's Bloomington, Indiana Field Office completed a 5-Year Review of the Indiana bat (USFWS 2009), which found that the all of the required recovery criteria for the Indiana bat had not been achieved and, thus, the species should remain at its current 'endangered' status.

### 2.1.1 Species Description

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in caves and mines in the winter and summers in wooded areas. It is a medium-sized bat, having a wing span of 9 to 11 inches and weighing only one-quarter of an ounce. It has brown to dark-brown fur and the facial area often has a pinkish appearance. The Indiana bat closely resembles the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). It is distinguished from these species by its foot structure and fur color.

### 2.1.2 Life History

*Life Cycle*
The Indiana bat is a migratory bat, hibernating in caves and mines in the winter (typically October through April) and migrating to summer habitat. Although some Indiana bat bachelor colonies have been observed (Hall 1962; Carter et al. 2001), males and non-reproductive females typically do not roost in colonies and may stay close to their hibernacula (Whitaker and Brack 2002) or migrate long distances to their summer habitat (Kurta and Rice 2002). Both males and females return to hibernacula in late summer or early fall to mate and store up fat reserves for hibernation. By mid-November, male and female Indiana bats have entered hibernation. They typically emerge in April, at which time they again migrate to summer habitat.

*Longevity*
The average life span of the Indiana bat is 5 to 10 years, but banded individuals have been documented living as long as 14 and 15 years (Humphrey and Cope 1977).

*Reproduction*
Female Indiana bats, like most temperate members of the family Vespertilionidae, give birth to one pup each year (Mumford and Calvert 1960; Thomson 1982). The sex ratio of the Indiana bat is generally reported as equal or nearly equal based on early work by Hall (1962), Myers (1964), and LaVal and LaVal (1980).

*Seasonal Distribution Patterns*
Summering Indiana bats (males and females) roost in trees in riparian, bottomland, and upland forests. Male bats disperse throughout the range and roost individually or in small groups, with many staying near hibernacula (i.e., caves and mines) and roosting individually or in small

groups (Whitaker and Brack 2002). Reproductive females form larger groups, referred to as maternity colonies in which they raise their pups.

This life history strategy (forming colonies) reduces thermoregulatory costs, which in turn, increases the amount of energy available for birthing and raising of pups (Barclay and Harder 2003 as cited in USFWS 2007). Most documented maternity colonies have 50 to 100 adult bats (USFWS 2007). When pups become capable of flight (early to late July) the maternity colony begins to disperse and use of primary maternity roosts diminishes, even though bats stay in the area prior to migrating back to their respective hibernacula. Bats become less gregarious and the colony utilizes more alternate roosts.

When arriving at their traditional hibernacula in August–September, Indiana bats "swarm." Some male bats may begin to arrive at hibernacula as early as July. Studies suggest that the majority of foraging habitat in spring and autumn is within 2 miles of the hibernacula, but extends to 5 miles or more. Therefore, it is not only important to protect the caves in which the bats hibernate, but also to maintain and protect the quality and quantity of roosting and foraging habitat within 5 miles of each Indiana bat hibernaculum.

During swarming, males are active over a longer period of time at cave entrances than females, probably to mate with females as they arrive. After mating, females soon enter into hibernation. Most bats are hibernating by the end of November, but hibernacula populations may continue to increase (USFWS 2007). Indiana bats cluster and hibernate on in caves from approximately October through April.

Most Indiana bats emerge in late March or early April, with females emerging first followed by the males. The timing of annual emergence may vary across the range depending on latitude and annual weather conditions. During the period after hibernation but prior to spring migration, which is typically referred to as "staging," the bats forage for a few days or weeks near their hibernaculum before migrating to their traditional summer roosting areas. Shortly after emerging from hibernation, the females become pregnant via delayed fertilization from the sperm that has been stored in their reproductive tracts through the winter (USFWS 2007). Most populations leave their hibernacula by late April. Migration is stressful for the Indiana bat, particularly in the spring when their fat reserves and food supplies are low. As a result, adult mortality may be the highest in late March and April.

### 2.1.3 Habitat Characteristics and Use

*Winter*

Indiana bats roost in caves or mines with configurations that provide a suitable temperature and humidity microclimate (Brack et al. 2003; USFWS 2007). Hibernacula often contain large populations of several species of bats.

Spring emergence occurs when outside temperatures have increased and insects (forage) are more abundant (Richter et al. 1993). Some bats may remain in close proximity to the cave for a few days before migrating, while other may head directly to summer habitats. This activity is known as spring staging.

*Summer*
Home range size may vary between seasons, sexes, and reproductive status of the females (Lacki et al. 2007). Without site-specific data, the Service generally considers the potential home range for an Indiana bat to include all suitable habitat within 2.5 miles of documented roost(s) (USFWS 2011), recognizing the area of actual use may be just a portion of that area.

Summer - Maternity
Indiana bats exhibit strong site fidelity to their traditional summer colony areas and foraging habitat, that is, they return to the same summer range annually to give birth (Kurta et al. 2002; Garner and Gardner 1992; USFWS 2007). Indiana bat maternity colonies typically occupy multiple roosts in riparian, bottomland, and upland forests. It is not known how long or how far female Indiana bats will search to find new roosting habitat if their traditional roost habitat is lost or degraded during the winter. If they are required to search for new roosting habitat in the spring, it is assumed that this effort places additional stress on pregnant females at a time when fat reserves are low or depleted and they are already stressed from the energy demands of migration and pregnancy.

While these characteristics are typical, research is showing adaptability in habitats used. Recent research has shown bats using upland forest for roosting and upland forest, and pastures with scattered trees for foraging. Indiana bats prefer forests with old growth characteristics, such as large trees, scattered canopy gaps, and open understories (USFWS 2007). The Indiana bat may persist in highly altered and fragmented forest landscapes for some unknown period of time.

Summer – Non-maternity
Non-reproductive females and males may roost individually or in small groups, but occasionally are found roosting with reproductive females. While Indiana bats primarily roost in trees, some colonies have been found in artificial roost sites (e.g., buildings, bat boxes) (USFWS 2007).

Many male Indiana bats appear to remain at or near the hibernacula in summer with some fanning out in a broad band around the hibernacula (Whitaker and Brack 2002). Because males typically roost individually or in small groups, the average size of their roost trees tends to be smaller than the roost trees used by female maternity colonies. Males may occasionally roost in caves. Males have also shown summer site fidelity and have been recaptured in foraging areas from prior years (USFWS 2007).

Roost Trees
Suitability of a roost tree is determined by its condition (dead or alive), suitability of loose bark, tree's solar exposure, spatial relationship to other trees, and tree's spatial relationship to water sources and foraging areas. Roost longevity is variable due to many factors such as the rate at which bark sloughs off or the tree falls down. Trees in excess of 16 inches diameter at breast height (dbh) are considered optimal for maternity colony roost sites, but trees in excess of 9 inches dbh are often used as alternate maternity roosts. Male Indiana bats have been observed roosting in trees as small as 2.5 inches dbh (Gumbert et al. 2002). Females have been documented using roost trees as small as 5.5 inches (Kurta 2005). Weather has been found to have profound influence on bat behavior and habitat use (Humphrey et al. 1977).

Foraging
The Indiana bat feeds primarily on aquatic and terrestrial insects. Diet varies seasonally and variations exist among different ages, sexes, and reproductive status (USFWS 1999). Drinking water is essential, especially when bats actively forage. Throughout most of the summer range, Indiana bats frequently forage along riparian corridors and obtain water from streams. However, ponds and water-filled road ruts in the forest uplands are also very important water sources for Indiana bats. Like most bats, the Indiana bat forages primarily at night and during twilight hours.

### 2.1.4 Status and Distribution

*Reason for Listing*
From 1965 through 2001, there was an overall decline in Indiana bat populations, with winter habitat modifications having been linked to changes in populations at some of the most important hibernacula (USFWS 2007). Summer habitat modification is also suspected to have contributed to the decline of bat populations; however, it is difficult to quantify how forest management or disturbance may affect Indiana bats. Further, environmental contaminants (USFWS 2007), climate change (Clawson 2002) and collisions with man-made objects such as wind turbines, communication towers, and vehicles (Good et al. 2011) may be considered a potential threats to Indiana bats.

Due to the species' low reproductive potential (i.e., ≤1 pup produced per adult female per year), threats that increase mortality or decrease recruitment are of particular concern. While reducing threats can yield population increases, these increases are gradual because of the species low reproductive rate.

*Rangewide Trends*
The Service's Bloomington Field Office has collated the population data gathered during the 2007 through 2013 biennial winter hibernacula surveys from throughout the Indiana bat's range and preliminarily determined that the Indiana bat's 2013 range-wide population stands at approximately 534,239 bats, which is a 3.3 percent decrease over the 2011 range-wide population estimate of 552,470 bats (Figure 1). These numbers include a new Priority 1 hibernaculum discovered in Missouri in 2012. To avoid an artificial spike in population trends, the additional 123,000 bats were added to population estimates back to 1981 (USFWS 2014a). The range-wide, biennial population estimates had been increasing from 2001 to 2007, indicating that the species' long-term decline had been arrested and likely reversed (USFWS 2014a). The observed range-wide decline since 2007 is likely attributable to White-Nose Syndrome (or "WNS") (see discussion below), especially for decreased population estimates in the Northeast Recovery Unit.

*Current Winter Distribution*
Winter surveys in 2012–2013 found hibernating Indiana bats dispersed across 16 states. However, over 90 percent of the estimated range-wide population hibernated in four states – Indiana (42 percent), Missouri (26 percent), Kentucky (11 percent), and Illinois (10 percent) (See

Figure 2; USFWS 2014a). For more information on wintering bat distribution, abundance, and potential genetic variation, see the Indiana Bat Draft Recovery Plan (USFWS 2007).

*Current Summer Distribution*

Summer distribution of the Indiana bat occurs throughout a wider geographic area than its winter distribution. Most summer occurrences are from the upper Midwest including southern Iowa, northern Missouri, much of Illinois and Indiana, southern Michigan, Wisconsin, western Ohio, and Kentucky. In the past decade, many summer maternity colonies have been found in the northeastern states of Pennsylvania, Vermont, New Jersey, New York, West Virginia, and Maryland. Maternity colonies extend south as far as northern Arkansas, Georgia, Alabama, Mississippi (Piper Roby, pers. comm. 2014), and southwestern North Carolina (Britzke et al. 2003; USFWS 2007). Non-reproductive summer records for the Indiana bat have also been documented in eastern Oklahoma, northern Mississippi, Alabama, and Georgia.

*Maternity Colonies*

The first Indiana bat maternity colony was not discovered until 1971 in east-central Indiana (Cope et al. 1974). As of publication of the Indiana Bat Draft Recovery Plan (USFWS 2007), we have records of 269 maternity colonies in 16 states that are considered locally extant. Of the 269 colonies, 54 percent (n=146) have been found between 1997 and 2007, mostly during mist-netting surveys. Additional maternity colonies have been found throughout the range since this time, but a range-wide tally has not been conducted since 2007. Because maternity colonies are widely dispersed during the summer and difficult to locate, it is presumed that all the combined summer survey efforts have found only a small fraction of the maternity colonies that are thought to exist.

In areas where WNS has affected bat populations for multiple years, resulting in very high mortality rates, entire maternity colonies have probably been eliminated because all the hibernating populations that supported those colonies have been decimated. If the resulting reduction in colony size is substantial, the colony may collapse because so few females remain to form the social clustering that is characteristic of the species and likely contributes to its survival and successful recruitment. However, other maternity colonies may stabilize at smaller sizes and eventually rebound. Regardless of how one estimates the number of maternity colonies, the declining hibernating population likely translates to a declining summer population.

*Adult Males*

Male Indiana bats are found throughout the range of the species, but in summer are most common in areas near hibernacula (Gardner and Cook 2002). Because they typically roost solitarily in the summer, they are less likely to be detected by mist-netting than adult females, which tend to occur in high-density maternity colonies. However, males may also roost with maternity colonies.

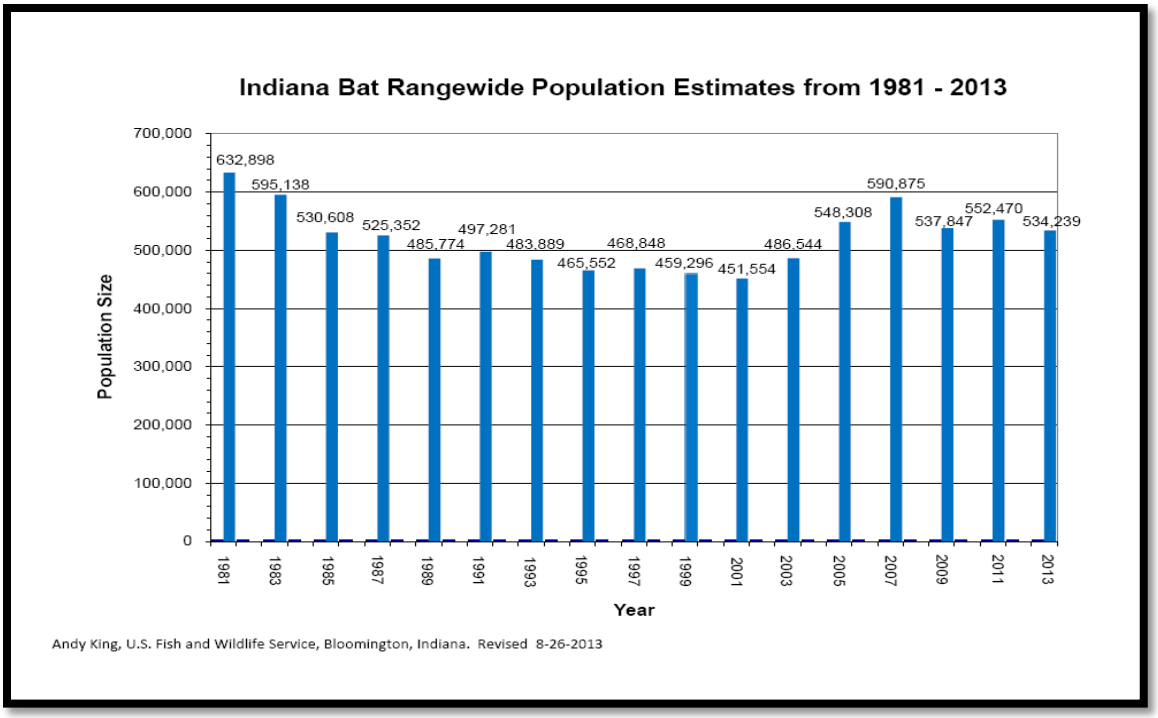


**Figure 1**: Indiana bat rangewide population estimates from 1981 through 2013.

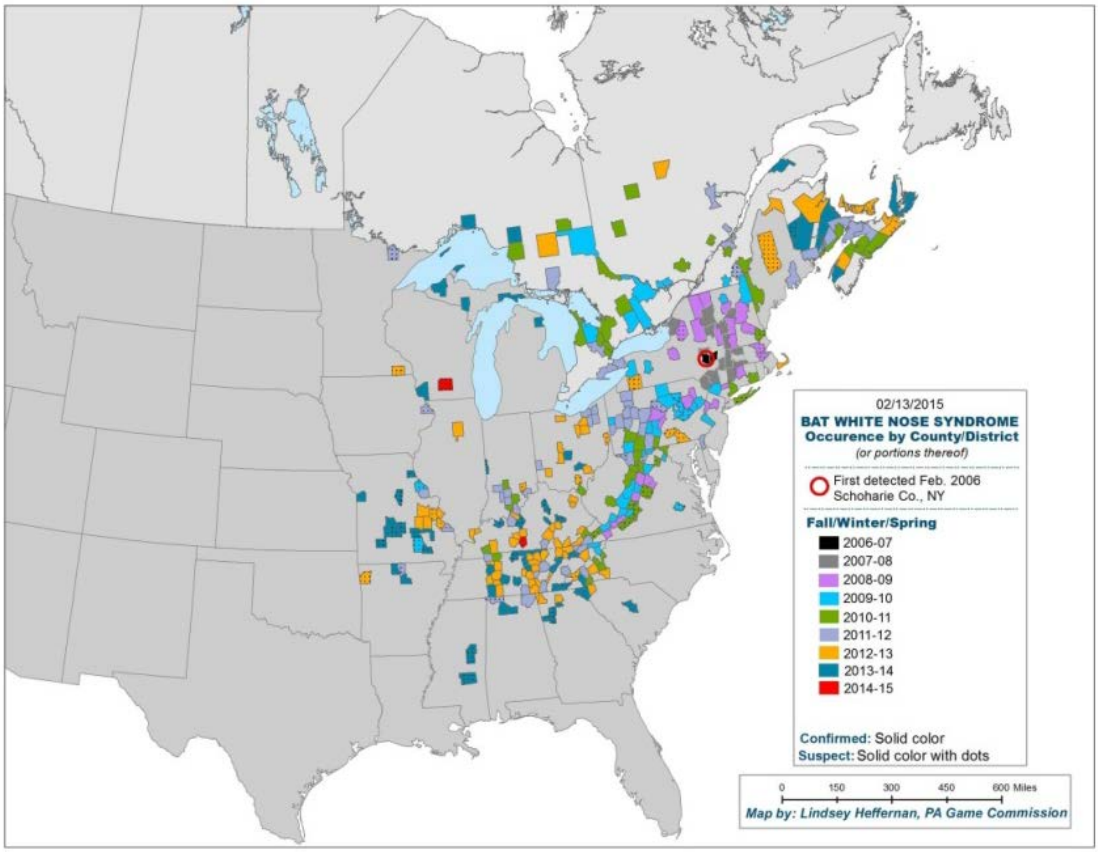


**Figure 2**: White nose syndrome (WNS) occurrence by county.

### 2.1.5 Threats

*White-nose Syndrome*
Prior to the current white-nose syndrome (WNS) epizootic, significant disease outbreaks affecting populations of Indiana bats or other North American bat species were not known. As discussed in the BA, WNS has emerged as an unprecedented threat to hibernating bat species in North America, including the Indiana bat.

At the end of the 2013–2014 hibernating season, white-nose syndrome had been documented in 25 states and 5 Canadian provinces (see Figure 2), with the apparent degree of impact to bats varying greatly by site and species. Based on observations of continued mass-mortality at several sites in the Northeast and mid-Atlantic regions, we anticipate that WNS will continue to spread rapidly, moving into and through the Midwest, South, and eventually Great Plains over the next couple of years. If current trends for spread and mortality at affected sites continue, WNS threatens to drastically reduce the abundance of many species of hibernating bats in much of North America. Population modeling indicates a 99 percent chance of regional extinction of the little brown bat in the Northeast within the next 16 years due to WNS (Frick et al. 2010). The closely-related Indiana bat may be equally vulnerable due to its smaller range-wide population and social behavior traits that increase the risk of bat-to-bat transmission of the fungus that causes WNS.

Impacts to Indiana bats have been inconsistent between affected hibernacula. The following is a summary of what has been observed in New York at the larger sites, comparing the most recent counts to the last count conducted prior to signs of WNS (generally 2005 or 2007 counts):

- Haile's Cave; 100 percent decline from 685 bats in 2005 to 0 every year since.
- Williams Preserve Mine; 98.5 percent decline from 13,014 in 2007 to 190 in 2010.
- Williams Lake Mine; 97.4 percent decline from 1,003 in 2007 to 26 in 2010.
- Glen Park; 73.6 percent decline from 1,928 in 2007 to 509 in 2010.
- Williams Hotel Mine; 66.5 percent decline from 24,317 in 2007 to 8,152 in 2010.
- Jamesville; 20.7 percent decline from 2,932 in 2007 to 2,324 in 2009.
- Barton Hill Mine; 13.7 percent increase from 9,393 in 2007 to 10,678 in 2010.

Based on observations of continued mass mortality at several sites, we anticipate the loss of Indiana bats to continue in the Northeast/mid-Atlantic regions as well as the Midwest in future winters. In addition, we anticipate that WNS will continue to radiate out to new sites, with WNS only documented in the largest Indiana bat hibernacula in the Midwest over the past couple years. The potential for climate, or some other environmental factor, to influence the spread of WNS, or the severity of its impact on affected bats, remains unknown. Final range wide counts from the 2014–2015 winter survey season will continue to reveal the severity of the spread and impacts of WNS. Given the evidence to date, however, the Service considers WNS to be the single-most destructive and significant threat to the Indiana bat.

Additional information on WNS, which is constantly evolving, can be found online at http://whitenosesyndrome.org/.

*Wind Energy*
There is growing concern that Indiana bats (and other bat species) may be threatened by the recent surge in construction and operation of wind turbines across the species' range. Until the fall of 2009, no known mortality of an Indiana bat had been associated with the operation of a wind turbine/farm. The first documented wind-turbine mortality event occurred during the fall migration period in 2009 at a wind farm in Benton County, Indiana. Since that time, four additional deaths have been documented.[1] While it is assumed that other Indiana bat mortalities have occurred, these five represent the only documented deaths at wind facilities. In October 2011 the Service released the "Indiana bat Section 7 and Section 10 Guidance for Wind Energy Projects," which is being used range-wide.

### 2.1.6 Recovery Criteria

Since the Indiana bat's initial listing, the recovery program has largely been focused on protection of important hibernacula (USFWS 1983). The proposed recovery program outlined in the draft Recovery Plan (USFWS 2007) has four broad components: (a) range-wide population monitoring at the hibernacula with improvements in survey techniques; (b) conservation and management of habitat (hibernacula, swarming, and summer); (c) further research into the requirements of and threats to the species; and (d) public education and outreach. This recovery program continues to have a primary focus on protection of hibernacula but also increases the focus on summer habitat and proposes use of Recovery Units.

*Recovery Units*
The Service's proposed delineation of Recovery Units (RUs) relied on a combination of preliminary evidence of population discreteness and genetic differentiation, differences in population trends, and broad-level differences in macrohabitats and land use (USFWS 2007). The Indiana Bat Draft Recovery Plan proposes four RUs for the species: Ozark-Central, Midwest, Appalachian Mountains, and Northeast (USFWS 2007) (Figure 3). The Action Area is primarily contained within the Midwest RU but crosses into Appalachian Mountains RU for the included portions of Virginia, West Virginia and a small part of Tennessee. It also crosses into the Ozark-Central RU for the covered portions of Missouri and Illinois.

[1] http://www.fws.gov/midwest/wind/wildlifeimpacts/inbafatalitiesJuly2013.html

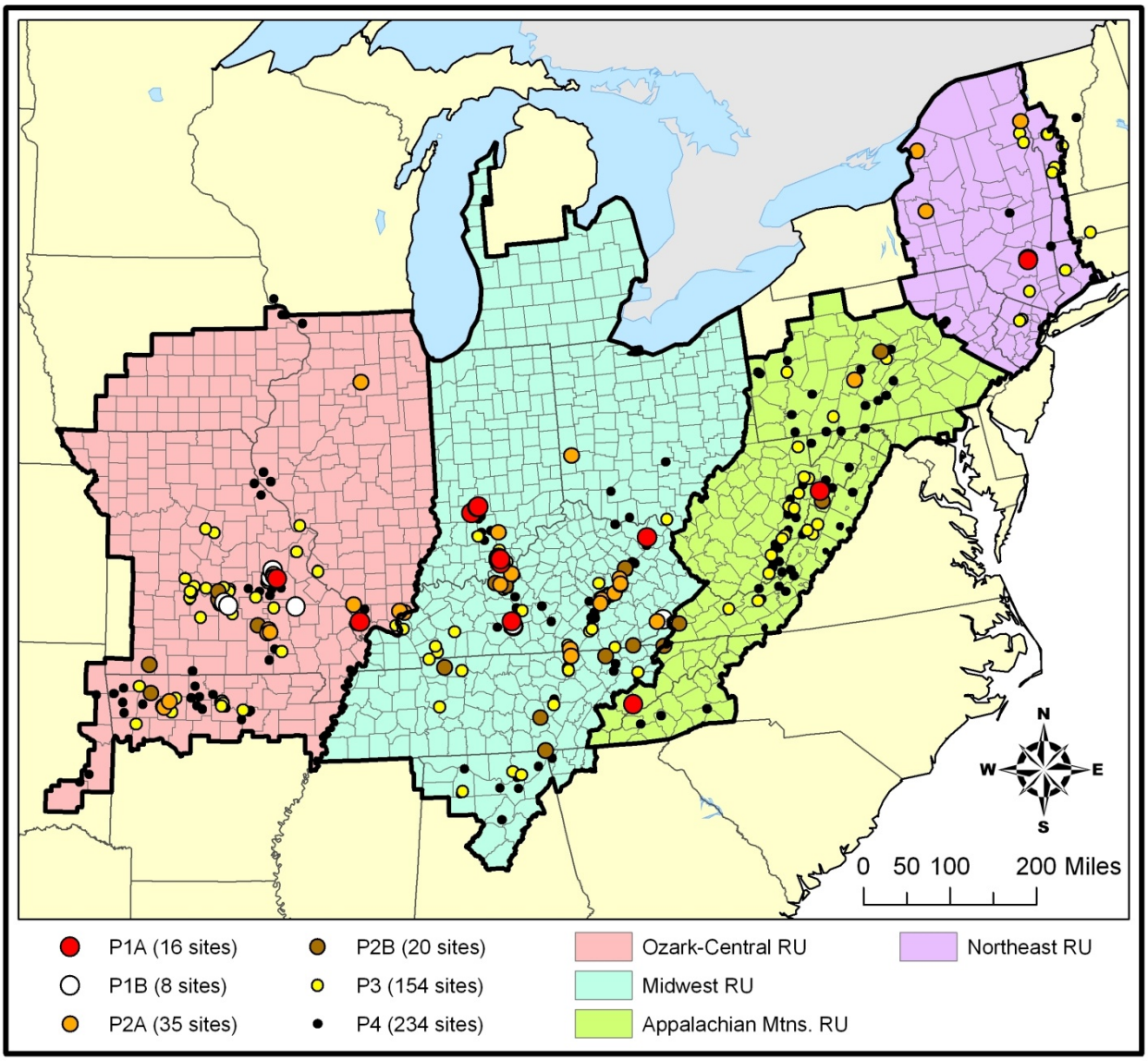


**Figure 3.** Proposed Recovery Units for the Indiana bat in relation to locations of known hibernacula.

### 2.1.7 Previous Incidental Take Exemptions

Prior formal consultations involving the Indiana bat have involved a variety of action agencies and project types. These have included:

- The Forest Service for activities implemented under various Land and Resource Management Plans (LRMPs) on National Forests (NFs) in the eastern United States;
- The Federal Highway Administration for various transportation projects;
- The U.S. Army Corps of Engineers (Corps), Federal Energy Regulatory Commission (FERC), Tennessee Valley Authority (TVA) and West Virginia Department of Environmental Protection for various water-related and coal mining projects;

- The Department of Defense for operations at several different military installations;
- The National Park Service for vegetation management and prescribed burn activities; and
- The Fish and Wildlife Service for the management of national wildlife refuges and section 10 activities.

A summary of the formal consultations completed since 1998 is discussed below and provided in Appendix A. Formal consultations on the Indiana bat completed prior to 2000 were omitted from the numerical analysis. This was done, because the incidental take provided prior to 2000 would not be expected to affect the current environmental baseline for the Action. This is due to several reasons, including:

- The effects of the take occurred in the past and current population and other data are available that give us a better estimate of the environmental baseline;
- The authorized take in many biological opinions has been superseded by new biological opinions; and
- The relationship of the take in these older biological opinions and the applicability of such take to this biological opinion is tenuous, at best, because of the difficulty in drawing meaningful comparisons and conclusions for projects that may be geographically separated and not similar in their effects on the Indiana bat.

In conducting many of these consultations, Indiana bat presence/absence survey information was unavailable, so the Service often relied on a variety of factors to assist the action agency in determining if Indiana bats could be present. For example, if survey information indicated that Indiana bats were present in nearby areas, the action agency often assumed that Indiana bats were present in the Action Area and could be subject to incidental take. Further, if the best scientific and commercial data available indicated that an Indiana bat maternity colony could be present, a maternity colony was generally assumed to be present within the Action Area. This type of conservative approach is generally protective of Indiana bats because it tends to over-estimate the incidental take that may occur. In most such cases, including the Action, the Service analyzes the effect of the worst case for incidental take on the proposed action but acknowledges that the worst case is unlikely to occur. The fact that the worst case is unlikely to occur is primarily due to implementation of conservation measures related to the CMOA process and other actions by the action agency to avoid and/or minimize incidental take.

Previous consultations have addressed impacts to hibernating or swarming bats, known maternity areas, or summer habitat that was assumed occupied. Due to the various life stages affected, the types of conservative assumptions made (as discussed above), and the difficultly in documenting actual take to Indiana bats (as more fully described in each biological opinion and the Incidental Take Statement section of this BO), different methods have been used to estimate the amount of actual and/or potential take. Depending on the consultation, take has been measured either by estimating numbers of affected roost trees, individual bats or maternity colonies, or acres of potentially suitable and/or occupied habitat. However, the Service typically has determined the incidental take measure that was used based on the most accurate and reasonable means available for each site-specific analysis. For example, Appendix A shows that biological opinions have exempted take of Indiana bats on about 3,003,762 acres of habitat since 2000.

Of this exempted take, approximately 228,985 acres have been superseded by new biological opinions, which reduce the total take acreage to 2,774,777 acres range-wide. It is important to subtract out the acreage of incidental take exempted in those biological opinions which are no longer in effect as failure to so would result in potential double counting of the affected acres. An example of this would be the 2004 and 2007 biological opinions for the Daniel Boone NF Revised LRMP. Both biological opinions exempt take on 54,350 acres of the forest. However, these are the same acres and failure to subtract out the 2004 incidental take amount (which is superseded by the 2007 revised biological opinion) would result in double counting of the exempted take.

Of the 2,774,777 acres of exempted take currently active, approximately 2,620,141 acres (93.7 percent) are for the U.S. Forest Service, primarily for NF LRMPs which are typically valid for a 10-year period. In assessing the acreage of incidental take exempted in these biological opinions, the Service multiplied any per year incidental take issued for an LRMP by 10 (standard effective period for an LRMP) to obtain the total exempted incidental take. Thus, the provided estimate of exempted incidental take is likely to be artificially high as many of the acres are not geographically distinct from one another and may be double counted (or more) if management actions resulting in incidental take occur more than once during a 10-year period at the same location.

A good example of this relationship exists for the biological opinion for the Northeast Research Station, where forest stands are harvested multiple times over many years, with each entry being counted as a separate acre of annual take (USFWS 2005b). Prescribed fire is another activity common on NFs that while being given an annual acreage of exempted take, this take does not occur on geographically distinct locations each year, rather it often involves replicated burns on the same sites at re-occurring intervals. Therefore, it is difficult, for the reasons discussed previously in this section, to measure the effects of previously authorized take without knowing the details of each biological opinion and closely evaluating the outcome of each consultation. Furthermore, even when we have the details of a biological opinion and are able to evaluate the outcome, we may not be able to draw realistic conclusions regarding the short- and/or long-term effect of any incidental take that has occurred due to the difficulty in monitoring and estimating incidental take of Indiana bats.

For example, several NFs and one Forest Service Research Station within the range of the Indiana bat have completed consultation at the programmatic level. Consultation under section 7 of the ESA is necessary to ensure Federal agency actions are not likely to jeopardize the continued existence of listed species or result in the destruction or modification of critical habitat of such species. The Service concluded that the proposed Forest Plans were unlikely to jeopardize the continued existence of the Indiana bat and issued biological opinions with associated incidental take statements. Although these incidental take statements anticipated the potential take of reproductive females, we have not confirmed population declines or the loss of any maternity colonies on a NF as a result of Forest Plan implementation.

The reasons for the lack of confirmed take of an Indiana bat maternity colony are likely two-fold. First, notwithstanding the conservative assumption that a maternity colony existed in the Action Area, to date, only fourteen maternity colonies have been actually confirmed to exist on the

affected NFs (i.e., the Daniel Boone NF (7), Hoosier NF (2), Mark Twain NF (1), Monongahela NF (1), Nantahala NF (1), and Shawnee NF (2)). Surveys to identify and confirm other maternity colonies on the Daniel Boone NF and other NFs are ongoing but are not systematic. The NFs covered by these biological opinions generally conduct some form of Indiana bat population monitoring, including mist net surveys, acoustical monitoring, and hibernacula surveys, as appropriate. These surveys have served to document either: (a) the continued presence of Indiana bats on the forests; (b) the discovery of new maternity colonies on the subject forest; or (c) the continued lack of presence of Indiana bats even though the conservative assumption of potential presence was made. Second, each Forest Plan includes conservation measures (i.e., standards and guidelines) that are protective of Indiana bats and their habitat and the reasonable and prudent measures required by each biological opinion that are applicable to each proposed action. These conservation measures and reasonable and prudent measures are designed to protect all known or newly discovered maternity colonies and to ensure an abundance of suitable Indiana bat habitat on the NFs.

Incidental take exempted on NFs is typically monitored and reported by acres of habitat lost, altered, or otherwise affected by a covered project. Based on the anticipated levels of take provided in the biological opinions for NF LRMPs, over 95 percent of these acres are affected by varying degrees of temporary loss as a result of timber management activities or prescribed burns (USFWS 2005a). However, much of this incidental take is take that is assumed to occur and based on a conservative assumption of take. Recording of actual incidental take is difficult, if not impossible, in most situations due to the difficulties in knowing if Indiana bats are actually present within an affected area and whether they are actually harmed, harassed, or killed. The Service or a federal action agency seldom has complete information when initiating a proposed project that could adversely affect Indiana bats and even more seldom is able to document that an actual take has occurred (e.g., a dead Indiana bat is found after implementation of the project). Nonetheless, each biological opinion requires that the NF monitor and report on the amount of habitat that is altered annually, so these are the best data available on the amount of take that may have occurred.

Further, this exempted incidental take does not account for the expected habitat gains (beneficial effects) associated with many of these NF projects. Prescribed burning on NFs operating under programmatic biological opinions is likely to improve foraging and roosting habitat for Indiana bats by increasing the number of snags, creating scattered canopy gaps, opening up the understory, and increasing the available prey base. Many of the management plans include standards that focus on avoiding the cutting of trees that are most likely to contain a maternity colony or a roosting bat. For example, the Monongahela NF plan calls for retaining all shagbark hickories with a diameter-at-breast height (dbh) of five inches or more within its timber harvest areas as well as retaining a minimum number of snags per acre. The habitat gains associated with these measures do not reduce the amount of incidental take exempted but avoid or minimize long-term adverse effects of these actions on the Indiana bat.

In order to ensure that the anticipated level of take is not exceeded, however, each NF provides annual reports of the actual level of take that has been implemented. Although reported levels have not been compiled for all the NFs, the actual incidental take used has been less than the

level exempted in the biological opinions for many NFs. If incidental take is exceeded, re-initiation of consultation is necessary.

A number of incidental take statements have also been issued to other Federal agencies conducting activities that were determined not likely to jeopardize the Indiana bat. Unlike the incidental take statements issued for the NFs LRMPs, some of these other Federal agency actions were certain to impact known, occupied habitat for Indiana bats. To minimize the effect of these projects, the Federal action agencies agreed to implement various conservation measures and to implement the reasonable and prudent measures (if any) contained in the respective biological opinions for those projects. Some of the measures implemented in these proposed actions included: (a) seasonal clearing restrictions to avoid disturbing female Indiana bats and pups; (b) protection of all known primary and alternate roost trees with appropriate buffers; (c) retention of adequate roosting and foraging habitat to sustain the maternity colony into the future; and (d) permanent protection of areas and habitat enhancement or creation measures to provide future roosting and foraging habitat opportunities.

The extent of exempted take since 2000 for non-U.S. Forest Service projects (including other Federal agencies and Habitat Conservation Plans (HCPs)) is estimated at 154,636 acres of suitable habitat as a surrogate measure of the take. One of the largest non-USFS incidental take exemptions included in this analysis is the 2008 Indiana bat Conservation Memoranda of Agreement biological opinion, which exempted the taking associated with up to 40,000 acres of habitat over 5 years (8,000 acres/year over 5 years). Less than 1,300 acres of the 24,000 acres exempted were actually used. Before the 2008 opinion expired, the KFO revised the CMOA program and issued a biological opinion in 2011 that reduced the incidental take exempted to 12,500 acres over 5 years. Of these acres, less than 3,000 acres have been used to date. This BO supersedes the 2011 biological opinion.

The largest non-U.S. Forest Service take authorization was given to NiSource as part of their 50-year habitat conservation plan (HCP) which allows up to 69,900 acres of habitat loss over a 50 year period. The take statement associated with this HCP was issued in 2013.

With the exception of three (Fort Knox, Great Smoky Mountains National Park, and Laxare East and Black Contour Coal Mining projects), none of the biological opinions and associated incidental take statements issued for non-Forest Plan activities anticipated the loss of a maternity colony. The Fort Knox biological opinion [(1999)] exempted take of two potential maternity colonies and individual Indiana bats. However, the biological opinion did not specify whether the "take" consisted of loss of the colonies or take in the form of harm and harassment. Surveys in 2004 and 2006 in the immediate area where the take was provided on Fort Knox have shown that at least one maternity colony (and possibly two) still exists (Hawkins, et. al 2008). We have no data that tracks the take of maternity colonies for the Great Smoky Mountains National Park biological opinion, but additional monitoring of the maternity colony following the completion of the 2004 BO for the Laxare East and Black Castle Contour projects documented a colony much larger than previously anticipated. Additional project modifications subsequent to that discovery resulted in the retention of all known roost trees and protection of some potential foraging areas. Reinitiation of that consultation in 2006 concluded that while the colony would experience adverse effects, the colony should be able to persist through the life of the project.

Required monitoring for three additional consultations (Camp Atterbury, Newport Military Installation, and Indianapolis Airport) has confirmed that the affected colonies persisted through the life of the project and continue to exist today. We recognize that given the philopatric nature of Indiana bats and the long lifespan of the species, the full extent of the anticipated impacts may not yet have occurred. Further, the fitness of these colonies has not been evaluated. Nonetheless, these monitoring results indicate that the conservation measures to avoid and minimize the impacts of Federal projects appear to be effective to the extent that the projects did not result in the loss of these maternity colonies.

In summary, we believe the take exempted to date via section 7 consultations has resulted in negative impacts to the Indiana bat and its habitat, at a local scale. As many of these consultations necessarily made conservative assumptions about Indiana bat presence, we believe that the number of Indiana bats actually exposed to the environmental impacts of the Federal actions has been less than anticipated. Rangewide population trends (USFWS 2014) for the species show population increases between 2001 and 2007, prior to the arrival of WNS, suggesting that the net effect of the exempted take did not impact the species as a whole. Population declines between 2007 and 2013 can likely be best attributed to WNS. Furthermore, pre- and post-project implementation monitoring of several maternity colonies preliminarily suggests that proposed conservation measures, when employed in concert, appear to be effective in minimizing adverse effects on the affected Indiana bats, including maternity colonies, although this information cannot be considered definitive.

For reasons stated above, the Service concludes that the aggregate effects of the activities and incidental take covered in previous biological opinions on the Indiana bat have not degraded the rangewide conservation status (i.e., environmental baseline) of the Indiana bat.

## 2.2 Environmental Baseline

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the Indiana bat, its habitat, and ecosystem within the Action Area. The environmental baseline is a “snapshot” of the species’ health in the Action Area at the time of the consultation, and does not include the effects of the action under review.

### 2.2.1 Status of the Species within the Action Area

The Action Area’s surface land coverage is approximately 62,254 square miles, which represents less than 11 percent of the total range of the Indiana bat. The occupied range of the species (i.e., the collective home ranges of all individuals) within both the total range and the Action Area is unknown but is likely considerably smaller than the total range and Action Area, respectively, due to the presence of unsuitable habitats and unoccupied suitable habitats within both. According to our records, the Indiana bat is known from a number of locations within the Action Area.

The Action Area lies near the center of the species' range and numerous records of the species occupying summer and winter habitat exist. Occurrences of the species are clearly tied to the availability of the suitable summer and winter habitat. Potential winter habitat is static (assuming no anthropogenic alterations occur) in the landscape, because the caves and other underground features the species relies on for winter habitats do not change locations. However, the species will move from one winter habitat area to another to take advantage of better conditions in hibernacula, to take advantage of new hibernacula (e.g., mines), or to abandoned hibernacula that humans or other factors have altered or disturbed.

Within the Action Area there are 165 known hibernacula. Eleven of these are Priority 1 hibernacula (defined as harboring current or historic winter populations greater than 10,000 individuals and not identified as an ecological trap) (USFWS, unpublished data 2014) and three of these are designated as critical habitat (USFWS 2007). These eleven Priority 1 hibernacula had a combined estimated population of 214,099 Indiana bats in 2013, which represent approximately 39.7 percent of the rangewide estimated population (539,239) and 83.8 percent of the Indiana bats known to hibernate within the Action Area (255,436) (USFWS, unpublished data). Of these eleven hibernacula, five are located within the 20-mile buffer around the Commonwealth of Kentucky that forms the outer boundary of the Action Area, including the three largest hibernacula by population count.

Many of these hibernacula occur in areas of existing public or private conservation ownership. Of particular note are the Daniel Boone and Shawnee NFs that are managed by the U.S. Forest Service, Mammoth Cave and Cumberland Gap National Parks that are managed by the National Park Service, Carter Cave State Resort Park that is managed by the Kentucky Department of Parks, Harrison-Crawford State Forest that is managed by the Indiana Department of Natural Resources, and several parcels along Pine Mountain in Kentucky that are owned by a variety of state agencies and land trusts.

Summer records for the species occur across the Action Area, and over 60 maternity areas have been documented along with a number of locations for solitary males and non-reproductive females. Like the hibernacula, these known maternity colonies are scattered throughout the state with notable clusters of maternity colonies occurring near the Fort Knox Military Reservation, Jefferson Proving Ground Military Reservation, Mammoth Cave National Park, Daniel Boone NF, Shawnee Nation Forest, Pine Mountain, the Eastern Coalfields, and along the lower Ohio River floodplains. The BA provided an assessment of available forested land cover surrounding 22 known maternity roosts in Kentucky (KFO, unpublished data), with forest cover ranging from 7.10 to 92.8 percent forest within a 2.5 mile radius of the record.

In general, the habitat availability at known maternity sites appears to reflect the overall distribution of forest cover for the state. Outside of the maternity colonies found on Fort Knox Military Reservation and Mammoth Cave National Park, those maternity areas with an availability of at least 80 percent forest cover occur in the eastern third of the state where forestland cover frequently exceeds 75 percent. Similarly, in the western third of the state where percent of land in forest is typically below 50 percent, the availability of forested habitat for known Indiana bat maternity colonies is also below 50 percent. Based on the wide distribution and availability of summer habitat across the Action Area, Indiana bats can be expected to occur

at any location where its habitat needs can be met. Summer presence / probable absence surveys for the Indiana bat within Kentucky have found an average occupancy rate of 1.4 percent for post-WNS survey sites in potential maternity habitat. Given this occupancy rate and the regular discovery of new maternity colonies, the Service believes that are more maternity colonies within the Action Area than are currently documented.

### 2.2.2 Factors Affecting Species Environment within the Action Area

It is difficult to identify specific factors affecting the Indiana bat's environment within the Action Area, because the Action Area has been defined as the Commonwealth of Kentucky and all portions of adjoining states that occur within 20 miles of the Kentucky border. This BO is based on analysis at a programmatic level rather than at an individual project scale. However, we are able to determine that there are a number of current and long-term land uses and demographic trends which could affect Indiana bats within the Action Area.

*Forest Loss and Fragmentation*
Unlike most winter sites, summer habitat for Indiana bats is typically not static. It changes over time in its location, quality and quantity and is influenced by changes in land use, management and forest structure. These changes are natural or driven by human influence. Based on the similarities between Kentucky and the Action Area that were previously discussed in the "Action Area" section of this BO and the BA, the Service considers the following discussion of forest loss and fragmentation in Kentucky as representative of trends across the Action Area.

Forest loss and fragmentation have significant impacts on the location, quality and quantity of available summer habitat. The Kentucky Division of Forestry has identified forest loss and fragmentation as key threats to Kentucky's forests (KDF 2010). Forest loss is simply the conversion of forestland to some other land use, while fragmentation is the breaking up of large forest tracts into smaller tracts. The predicted change in Kentucky's forestland found in Turner et al. (2004) anticipates that 31 of the 120 Kentucky counties will lose 1–-5% percent of their forestland by 2020, and no county will increase its forest by more than 2 percent. A county by county comparison of percent forest cover as represented in the 2001 and 2011 editions of the National Land Cover Database found this to be generally true.

In the early 1900's, forest loss was primarily due to agricultural conversion; today surface mining and urban sprawl are driving the loss (KDF 2010). However, as some forest is lost, other land is becoming forested. This is evidenced by the relative stability of Kentucky's forested land use over the last fifty 50 years, which has consistently been just below 50 percent (Oswalt 2012). However, this is across the state and local trends vary.

While the state-wide forest availability has been stable, these forests have on average aged and support larger trees. The number of acres in seedling and poletimber-size stands has decreased while acres in sawtimber-sized stands increased. Sawtimber has a minimum dbh of 11 inches for hardwoods, and the greatest growth has been seen in the volume of trees with a dbh of 12 or more inches (Turner et. al 2004). This is important as larger-diameter trees presumably provide thermal advantages and more spaces for more bats to roost. As with most tree-roosting bats (Barclay and Kurta 2007), female Indiana bats probably select trees, especially primary roosts,

that are larger in diameter than nearby, apparently suitable, but unoccupied trees (Kurta et al. 1996, 2002; Britzke et al. 2003; Palm 2003; Sparks 2003).

Fragmentation is already a significant detriment to Kentucky's forest health. Although nearly half the state is forested, less than 14 percent of these 12.4 million acres are forest interior (KDF 2010). Within large forest tracts of 1,000 or more acres, 50 percent of the forest is considered edge habitat (300 foot buffer), 22 percent is small forest interior (less than 1,000 acres) and 28 percent is large forest interior (greater than 1,000 acres).

Forest loss and fragmentation can have significant impacts on Indiana bats particularly at the local level. Any increase in conversion of forested land to agricultural and/or developed lands can be expected to further fragment and eliminate forested blocks of habitat that could be used by Indiana bats. The extent to which this effect will be offset by new forest regeneration is unknown; any regenerated forest will typically require decades before it becomes suitable roosting habitat. These habitat loss and degradation trends can be expected to receive increased scrutiny as protection of important summer habitat becomes a critical aspect of the species' recovery following the population declines due to white-nose syndrome (Johnson et al. 2012).

*White-nose Syndrome*

A general overview of white-nose syndrome (WNS) and its effects on bat populations was previously provided in the section on the Status of the Species. This section will focus on its effects within the Action Area.

Kentucky has an aggressive WNS surveillance and monitoring program which began in 2009, gathering pre-WNS data in anticipation of its arrival. White-nose syndrome was first discovered in one cave in Kentucky in 2011. Ten additional sites were discovered during the 2012 survey season, followed by 30 sites in 2013 and 28 sites in 2014. In addition to the 69 infected sites discovered during winter surveys, 3 more sites were confirmed as WNS infected outside the winter survey timeframes. In total, 72 WNS infected sites have been discovered in Kentucky. Of the 72 hibernacula in Kentucky infected with WNS, 57 are Indiana bat hibernacula (KDFWR 2014, unpublished data). Mortality at infected sites first became apparent in 2013, with an increase in apparent mortality in 2014 based on reduced population counts. However, as of the end of the 2014 winter survey season, only three Indiana bats have been found dead at the hibernacula due to WNS.

Of the 72 infected hibernacula in Kentucky at the end of 2013, KDFWR has pre- and post-WNS trend data for 18 sites. At the 13 hibernacula for which trend data is available, Indiana bat numbers have declined at 10 sites and increased at 3 sites. Declines are most significant at B&O, a Priority 2 hibernaculum for the Indiana bat which has shown a 21 percent decline since the arrival of WNS. Other sites may have a larger percent decline but the starting population numbers at B&O of nearly 1,800 Indiana bats make the percent decline significant. These other sites are generally considered stable by the KDFWR based on pre- and post-WNS trend data (KDFWR 2014, unpublished data).

Although the population and trend data following the arrival of WNS at Kentucky hibernacula is difficult to interpret, at this time, it is not showing the near or total loss of Indiana bat

populations that has been documented in the northeastern United States. Based on hibernacula counts, Kentucky saw an 11.8 percent decline (from 70,598 to 62,233) in its Indiana bat winter populations between 2011 and 2013 (USFWS 2014a).

*Other Factors*
Numerous land use activities that could impact Indiana bats and that likely occur within the Action Area include: timber harvest, all-terrain vehicle (ATV) recreational use, recreational use of caves, underground and surface coal and limestone mining, gas production, and development associated with road, residential, industrial and agricultural development and related activities. These private actions are likely to occur within the Action Area, but the Service is unaware of any quantifiable information relating to the extent of private timber harvests within the Action Area, the amount of use of off-highway vehicles within the Action Area, or the amount of recreational use of caves within the Action Area. Similarly, the Service does not have any information on the amount or types of residential, industrial, or agricultural development that have or will occur within the Action Area. Therefore, the Service is unable to make any determinations or conduct any meaningful analysis of how these actions may or may not adversely and/or beneficially affect Indiana bats. All we can say is that it is possible that these activities, when they occur, may have direct, indirect, and/or cumulative effects on Indiana bats and their habitats in certain situations (e.g., a private timber harvest during summer months within an unknown maternity colony may cause adverse effects to that maternity colony.). In stating this, however, we can only speculate as to the extent or severity of those effects, if any.

## 2.3 Effects of the Action

This section addresses the direct and indirect effects of the Action on the Indiana bat, including the effects of interrelated and interdependent activities. Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the proposed action, but are later in time and reasonably certain to occur.

### 2.3.1 Factors Considered

Our analysis considered the following factors:

- Proximity of the action – We describe known species locations and designated critical habitat in the Action Area.
- Distribution – We describe where the Action will occur and the likely impacts of the activities.
- Timing – We describe the likely effects in relation to sensitive periods of the species' lifecycle.
- Nature of the effects – We describe how the effects of the Action may be manifested in elements of a species' lifecycle, population size or variability, or distribution, and how individual animals may be affected.
- Duration – We describe whether the effects are short-term, long-term, or permanent.
- Disturbance frequency – We describe how the Action will be implemented in terms of the number of events per unit of time.
- Disturbance intensity – We describe the effect of the disturbance on a population or

species.

- Disturbance severity – We describe how long we expect the adverse effects to persist and how long it would it take a population to recover.

*Proximity of the action*

The Action Area lies near the center of the range for the Indiana bat. Numerous records exist documenting that these species occupy summer and winter habitats within the Action Area. Winter habitat is generally limited to the karst regions where suitable caves can be used for hibernacula, but summer habitat is widely distributed throughout the Action Area where suitable forested habitat exists. For the Indiana bat, three designated critical habitat areas are located in Action Area – Bat Cave in Carter County, Kentucky, Coach Cave in Edmonson County, Kentucky, and Wyandotte Cave in Crawford County, Indiana. No summer habitat has been designated as critical habitat for the Indiana bat.

*Distribution*

The effects of the Action will vary depending on the location of the cooperator's project-specific impacts and the selected avoidance, minimization and compensation (mitigation) measure(s). Impacts associated with the implemented mitigation will typically occur in areas where Indiana bats are known or are expected to occur while those impacts associated with project-specific impacts will typically occur within the project footprint. However, it is certain that the Action, project-specific impacts, and mitigation measures approved under the Action will occur within the Action Area, and primarily within the boundaries of the Commonwealth of Kentucky. Incidental take exempted under the original and first revision of this biological opinion were widely distributed across the Commonwealth of Kentucky with occasional clusters of impacts near areas of new development where Indiana bats are known to be present. The first two iterations of the Conservation Strategy only addressed impacts to Indiana bats, as the northern long-eared bat was not yet proposed for listing.

The positive effects associated with the selected mitigation measures will typically occur within a Recovery and Mitigation Focus Area (RMFA). As is described in the Strategy, RMFAs were chosen based on a variety of factors (e.g., known presence of Indiana bat populations and/or existing conservation ownership, among others) that suggest these areas have the highest likelihood of supporting Indiana bat summer and/or winter populations in the long-term. The convergence of the mitigation efforts from one or more projects into the RMFAs will maximize the recovery-focused conservation benefits for Indiana bats in Kentucky and the Action Area.

*Timing*

Adverse effects related to the timing of the Action cannot be quantified, because the projects which might trigger implementation of the Strategy are driven by unpredictable factors (e.g., market forces). However, we expect the impacts will occur throughout the year and including during the following sensitive periods: the maternity period (mid-April through mid-August, see Status of the Species section) and fall swarming (late-August through mid-November). Detrimental impacts during these periods are expected to result in harm and harassment of adults and pups due to the removal of roost trees, degradation of habitat, alteration of travel and foraging areas, and other indeterminable habitat-related effects. During the non-volant period (June 1 through July 31) for juvenile Indiana bats, habitat removal in known and potential

maternity areas will require project-specific review and may require additional mitigation measures so that mortality of pups can be minimized or avoided.

During the spring staging period (early to mid-April), Indiana bats are still concentrated around the hibernacula. The bats have just awoken from hibernation and have depleted fat reserves. This is also the period when both species are preparing to migrate to their summer roosting areas. This migration may be hundreds of miles for female Indiana bats (see Status of the Species section). Impacts to Indiana bats during this sensitive period will be minimized by placing a 1-mile buffer around all P1 and P2 hibernacula and a 0.5-mile buffer around all P3 and P4 hibernacula. Staging is not expected to occur beyond this buffer and negative impacts within this buffer will require project-specific review to determine the appropriateness of the mitigation measures.

Bats are most sensitive to disturbance during hibernation (mid-November through March). The Strategy does not allow adverse effects to hibernating Indiana bats or their hibernacula to be covered under CMOAs.

While impacts to hibernating bats and hibernacula are avoided, the removal of some potential and known forested summer and swarming habitat may occur during the hibernation period. The winter removal of forested summer and swarming habitat may have an indirect adverse effect on the Indiana bats that use those habitats during the roosting period. The resulting impacts (e.g., alteration of normal behavior patterns) are not expected to result in the direct mortality of Indiana bats. However, these impacts may degrade their habitats through the loss of potential or known roost trees, the alteration of travel and foraging areas, and other indeterminable habitat-related effects. The energetic cost to Indiana bats returning to altered summer habitat is not known, but may be significant, particularly for pregnant females. This cost is expected to be higher for bats returning from WNS-infected hibernacula. The result of this could be in the form of reduced reproduction, fitness, or mortality.

*Nature of the Effect*

It is likely that the Action, resulting in project-specific impacts and associated mitigation measures, will have a variety of effects on individual Indiana bats, maternity colonies and swarming populations. In particular, the project-specific impacts are expected to: (a) eliminate known and potential foraging and roosting habitat through removal and/or conversion of that habitat (e.g., removal of maternity roost trees, summer and swarming roost trees, and foraging habitat); (b) alter habitat (e.g., fragmentation of foraging and roosting habitats, modification of travel corridors); (c) result in alteration and/or modification of normal behaviors (e.g., reproduction effects, foraging effects, and sheltering behaviors); and (d) potentially cause the mortality and/or injury of individual bats. Further, the mitigation measures associated with the project-specific impacts are expected to result in: (a) protection of previously unprotected winter habitat, (b) protection and/or management of summer and swarming habitats, and (c) funding of priority research and monitoring needs for Indiana bats. Critical habitat for the Indiana bat will not be impacted by the Action, and primary constituent elements of Indiana bat critical habitat area have not been defined.

*Duration*
The majority of the positive effects of the Action will be permanent, as will most of the adverse effects associated with each project-specific impact as defined within a CMOA. We expect protected lands will be protected and managed in perpetuity, and we expect that most impacts will also result in the permanent loss of forested Indiana bat habitat. However, there may be project-specific actions that only temporarily affect forested bat habitat. These would include forest management projects where forest stands are managed, thinned, or allowed to regenerate over time and may have both adverse and beneficial effects to Indiana bats.

*Disturbance Frequency*
The frequency at which project-specific impacts are implemented and associated impacts occur cannot be accurately determined. While the disturbance frequency cannot be determined, the amount of habitat that could be impacted on an annual basis is limited to 2,000 acres. Further, individual projects can only disturb up to 100 acres of suitable habitat. Based on these limits, and assuming that these maximum limits actually occur, there could be as few as 20 projects annually affecting each species. However, as individual project acreages decline, the number of projects causing adverse effects per year can increase.

Projects covered under CMOAs implemented between 2008 and August 2014 ranged in size from under one tenth of an acre to over 100 acres. However, the vast majority of projects covered under CMOAs resulted in less than 10 acres of forest removal. Out of 325 project-specific CMOAs from this timeframe, only 57 projects affected 10 acres or more, while the median impact size was 1.75 acres and the average was 8.7 acres. For years where CMOAs were completed over the full calendar year (2009–2013), the number of project specific CMOAs ranged from 30 (2009) to 71 (2012). While the KFO has historically seen less than 100 projects per year and the majority of projects were small (under 10 acres), the disturbance frequency cannot be predicted with accuracy because the KFO does not control the implementation of project-specific impacts.

*Disturbance Intensity*
The intensity of the disturbance is difficult to estimate, because we do not know how much of the habitat that may be removed is occupied by bats, nor do we know the density of Indiana bats using these areas. While the Action will result in some incidental take of Indiana bats, previous discussions (see Status of the Species and Environmental Baseline) indicate the likelihood that bats will adjust to project-specific impacts and occupy similar habitats within the Action Area without significant reductions in population size. The Action will affect less than 0.05 percent of the habitat available within the Action Area over its five year duration and less than 0.01 percent of available forested habitat in a given year.

*Disturbance Severity*
The KFO has deliberately restricted the project-specific impacts that can be implemented under the executed CMOAs in order to limit the severity of disturbance to Indiana bats. This is accomplished by excluding projects that impact hibernacula and by requiring project-specific evaluations for those impacts that exceed 100 acres, occur in known maternity areas during the period when pups are non-volant (June 1 through July 31), or occur in sensitive areas. The areas identified as sensitive include: the one mile radius surrounding P1 and P2 Indiana bat

hibernacula and the 0.5-mile radius surrounding Indiana bat P3 and P4 hibernacula. These minimization measures reduce the disturbance severity of the Action by identifying disturbances that would likely have an increased level of adverse effect and either excluding them from this process or requiring project-specific evaluations of the proposed impacts. For those projects that are accepted for inclusion in the Action but which also require project-specific reviews, additional mitigation measures may be required, as appropriate, in the CMOA. Additional mitigation measures may include, but are not limited to: increased habitat replacement ratios, intensive searches to identify potential roost trees so that those can be avoided if they contain pups, use of different approaches or equipment to remove habitat, etc. However, these will be necessitated by site-specific information and factors available at that time and cannot be accurately analyzed at this time.

In most cases, it is unlikely that a project will result in the immediate death of an individual bat; most adverse effects will be related to the reduced fitness of bats due to increases in energy expenditure as the result of behavioral modification due to the loss of roost trees, foraging areas and/or travel corridors. In these situations, we anticipate that, based on the wide availability of suitable habitat within the Action Area, the affected bats will be able to shift to other primary and secondary or alternate roost trees. Under a worst-case scenario, a primary maternity roost tree would be felled during a period when the pups were non-volant. Since it is unlikely that an entire maternity colony would be roosting in the same tree and a majority of adults in the affected tree would be able to fly out, it is, therefore, unlikely that the entire maternity colony would be lost. Belwood (2002) anecdotally describes the effects of such a worst-case scenario for Indiana bats as summarized below.

On July 8, 1996, in a residential suburb of Cincinnati, Ohio, private landowners felled a dead maple tree that was at risk of falling on their house. After felling the tree, the landowners noticed 34 Indiana bats that had scattered across the yard, including one dead lactating female and 33 non-volant pups (16 males and 17 females), three of which were dead. The surviving pups were placed in either a man-made bat house near the fallen tree or under loose bark on the downed maple. The placement of pups was completed at dark and almost immediately adult bats, presumably Indiana bats, began circling over the downed tree and bat house. The site was revisited the following morning and two dead juveniles were found in the bat house. A thorough examination of the bat house, the felled maple tree (all loose bark was removed) and the surrounding yard revealed no other carcasses indicating that the adult females returned for the non-volant pups. Reproductive females were caught in the vicinity a few weeks later suggesting that the colony relocated nearby after this catastrophic event (Belwood 2002).

Although this description is anecdotal, Belwood (2002) provides some important information that can be used to evaluate the effects of such a catastrophic event: (1) the majority of the Indiana bats (60 out of presumably 66) survived the felling of a primary maternity roost during a period of non-volancy in for the pups; (2) the adults and pups responded differently, the adults flew out and the pups scattered on the ground after the felling, which allowed the adults to retrieve and relocate the non-volant pups; and (3) the colony appeared to have persisted in the area, with what is assumed to be the same colony being discovered in a new roost tree only 20 meters from the original roost tree just five weeks after the initial discovery. Based on this information, the recovery rate for the affected maternity colony would be relatively short,

perhaps 2–3 maternity seasons and is unlikely to have a measurable effect on the population as a whole. This is important as such a catastrophe is considered to be potentially the most severe disturbance that may occur as a result of the Action. However, the likelihood of such a severe impact occurring as part of the Action is very low since tree clearing is restricted during the typical non-volant period of June 1 through July 31.

### 2.3.2 Analysis for Effects of the Action

Federal and non-federal entities who enter CMOAs with the KFO agree to implement the mitigation measures described in the Strategy. These measures are part of the effects that CMOA projects have on Indiana bats and their habitats. Projects implemented under CMOAs may adversely affect Indiana bats by removing or altering their roosting habitat. In addition to roosting habitat loss, projects may cause a decrease in the quality of habitat remaining within the Action Area, including increased habitat fragmentation, loss of foraging areas, loss of travel corridors, increased disturbance, and other forms of habitat degradation. The following sections describe the general effects of projects covered under CMOAs and are summarized from the BA; please refer to the BA for more information.

#### 2.3.2.1 General Habitat Removal

Disturbances caused by activities covered under the CMOAs may cause bats to flush from their roost trees during daylight or otherwise modify their normal behavior. The noise and vibration generated from habitat removal will likely occur during daylight hours and at variable distances from occupied roost trees. The novelty and intensity of these perturbations will likely dictate the range of responses to them. For instance, bats roosting at some distance from the disturbance or habitat removal may initially be startled by unusual noises in the distance but may habituate to the noises if they are of low volume or if some distance is maintained between the roost and the disturbance. At closer distances and increasing noise or vibration levels, bats may be startled to the point of fleeing from their roosts, which may increase the risks of injury, mortality, predation, abandonment of non-volant pups, and other adverse effects. Non-volant pups that are abandoned permanently are unlikely to survive.

Alternatively, bats that roost within or close to habitat removal areas will likely be subjected to increased levels of disturbance frequency and intensity. As a result, Indiana bats displaced by these activities may be forced to use different roost trees. These roost trees may be more or less suitable (e.g., easily accessed by predators) than the roosts from which they were displaced. Habitat conditions surrounding the disturbance area will likely determine the quality of any alternative roosts that are used.

We also anticipate that Indiana bats may change roosting areas by temporarily or permanently abandoning their current roosts and seeking roosts that are further away from the active disturbance area. This has been supported by a few accounts in the literature. For example, Callahan (1993) noted that the likely cause of the Indiana bats in his study area abandoning a primary roost tree was disturbance from a bulldozer clearing brush adjacent to the tree, and female bats in Illinois used roosts at least 1640 feet (500 meters) from paved roadways (Garner

and Gardener 1992). However, there are also studies that show that some amount of shifting roost tree usage is a normal behavior for Indiana bats (Kurta et al. 2002; Kurta 2005; Barclay and Kurta 2007; Foster et al. 2007) and is not only a response to an active disturbance.

Some literature has reported that Indiana bats used roosts close to significant disturbance. In one study near I-70 and the Indianapolis Airport, a primary maternity roost was located 1,970 feet (0.6 kilometer) south of I-70. This primary maternity roost was not abandoned despite constant noise from the Interstate and airport runways. However, the roost's proximity to I-70 may be related to a general lack of suitable roosting habitat in the vicinity and due to the fact that the noise levels from the airport were not novel to the bats (i.e., the bats had apparently habituated to the noise) (USFWS 2002). Therefore, we cannot say definitively that Indiana bats will shift or abandon their roosts as a result of any adjacent disturbances. Because we cannot accurately determine if the behavior would be normal roost shifting in all cases, we are assuming that such roost shifting is an adverse effect.

The Indiana bat appears able to adapt to some level of habitat loss and/or modification change within its summer and swarming habitats. However, the impact of these losses and modification on the fitness of the Indiana bat is unknown. Any activity that requires additional expenditures of energy to find new foraging areas, roost sites, or travel corridors can be expected to reduce a bat's fitness to some extent.

In addition to habitat loss, project-specific impacts may result in a decrease in the quality of habitat remaining within the Action Area. Factors that may lead to a loss in the quality of the remaining habitat include increased habitat fragmentation, loss of foraging areas and travel corridors, and the degradation of these habitats. Over time, it is expected that fragmentation of habitat in the Action Area will increase as impacts continue to occur.

#### 2.3.2.2 Impacts to Summer Habitats

For the Indiana bat, maternity habitat is suitable summer habitat used by juveniles and reproductive (pregnant, lactating, or post-lactating) females. The KFO analyzed the available forest habitat data for known Indiana bat maternity colonies in Kentucky and found that maternity colonies in the Action Area occur in areas with percent forest cover ranging from 8.8 percent to 94.6 percent. While these maternity colonies appear to occur in the habitat that is available in their range, the KFO has no mechanism or available data for determining the fitness of a given maternity colony relative to the amount of habitat available to each colony. Further, the KFO believes that there are more maternity colonies within the Action Area than are documented (known), therefore any project impacting suitable Indiana bat maternity habitat (where probable absence has not been demonstrated) is considered to have the potential to impact maternity colonies.

Regardless of how the habitat is removed, Indiana bats in a maternity colony or roosting individually (i.e., non-reproductive females and males) could be stressed, injured or killed as a result of the tree or branch striking the ground or due to being dislodged from the roost tree (i.e., falling to the ground). Although any volant bat can likely fly away from a tree prior to or during the direct impact, females may be less likely to leave if they have flightless (i.e., non-volant)

pups present (usually between June 1 and July 31). Flightless pups would not be capable of leaving their roost tree and, therefore, may be harmed, harassed, and/or killed. Once the pups become volant, their likelihood of surviving the removal of the habitat in which they are roosting increases.

Project-specific review is required for all projects within known or potential maternity habitat that would occur during this June 1 and July 31, while the pups are non-volant. In most cases, CMOA projects will not result in the removal of suitable habitat during that timeframe, in order to minimize the negative impacts to maternity colonies. However, there could be limited situations when project-specific evaluations determine that the proposed project is unlikely to result in mortality because suitable maternity roosts are identified and their removal avoided, or emergence counts show that the potential roosts trees are not occupied at that time.

While the loss of an occupied primary maternity roost would result in the greatest immediate impact, the loss of multiple roost trees could cause displaced individuals to expend increased levels of energy while seeking out replacement roost trees. However, given the available forested acreage within most maternity areas and the relatively small project sizes approved under this action, it is unlikely that any of the projects implemented under these CMOAs would result in the loss of all roosts for an entire maternity colony.

If increased energy expenditure occurred during a sensitive period of a bat's reproductive cycle (e.g., pregnancy), it is possible that spontaneous abortion or other stress-related reproductive delays or losses in fecundity may be a likely response in some individuals, particularly those that may have already been under other environmental stresses (e.g., WNS). It has been hypothesized that these stresses and delays in reproduction could also cause lower fat reserves and lead to lower winter survival rates (USFWS 2002). For example, females that give live birth may have pups with lower birth weights or their pups may have delayed development rates (i.e., late into the summer). This could, in turn, affect the overwinter survival of these young-of-the-year bats if they enter fall migration and winter hibernation periods with inadequate fat reserves.

Impacts to non-reproductive adults would be less than those impacts to reproductive females and juveniles, because there is less stresses on these individuals. However, these individuals are still likely to be impacted by the loss of summer habitat through increased energy expenditures associated with finding new roosting habitats, longer foraging distances or disrupted travel corridors. By restricting the acreage that can be removed under a CMOA to 100 acres or less, the Service believes that the effects of this forest loss on maternity colonies are minimized.

These stresses are anticipated, though to a lesser extent, even when the habitat is removed when the bats are not present. Bats returning to summer roosting ranges will be stressed from hibernation and potentially, a long migration. Additional energy expenditures required to find suitable roost sites will result in more stress on these individuals. This stress will be most detrimental to maternity colonies, which carry the additional stress of pregnancy.

Project-specific impacts associated with CMOAs executed between 2008 and mid-2014 were tracked by quantity (acreage) and type (e.g., maternity, swarming, etc.) of habitat. A review of those data found that impacts to known maternity habitat represented about 25.6 percent of the

total impacts (976 of 3,811 acres) associated with these projects. Assuming a similar level and distribution of impacts to maternity habitat across the 10,000 acres and 5 years of the Action, the Action will result in impacts to an estimated 2,560 acres of forested maternity habitat (10,000 acres X 0.256 = 2,560 acres). The Service assumes that maternity colonies require an average of 397 acres of habitat per colony (Menzel et. al 2005), that colonies do not overlap, and that each maternity colony represents 120 Indiana bats (60 adult females + 60 pups) (USFWS 2007). Based on these assumptions, the Action's effects on known summer maternity habitat would affect up to 774 Indiana bats:

- 2,560 acres of maternity habitat affected ÷ 397 acres per maternity colony = 6.45 colonies; and
- 6.45 colonies X 120 bats per colony = 774 bats.

However, the Service finds it unlikely that all maternity colonies within the Action Area are known and has chosen to assume all unknown suitable habitats have the potential to contain a maternity colony, unless survey data indicates otherwise.

The KFO reviewed Indiana bat presence/probable absence survey data in Kentucky post-WNS (2011–2014) and found that Indiana bats were detected at 1.4 percent (8 of 569 sites) of suitable mist-net sites. Applying this occupancy rate to the 7,440 acres of potential maternity habitat predicts that 104 of these acres are occupied by maternity colonies. These 104 acres represent an estimated 32 Indiana bats:

- 10,000 acres suitable habitat – 2,560 acres known maternity habitat = 7,440 acres potential maternity habitat;
- 7,440 acres potential maternity habitat X 0.014 occupancy rate = 104 acres;
- 104 acres ÷ 397 acres per maternity colony = 0.262 potential maternity colonies; and
- 0.262 potential maternity colonies X 120 bats per colony = 32 bats.

Combining the likely impacts to both known and potential summer maternity habitats, the Service anticipates that CMOA projects in known and potential summer habitat will affect up to 6.7 (6.45 + 0.26 = 6.71) Indiana bat maternity colonies or 806 (774 + 32 = 806) over a 5-year period. A small, but indeterminable, portion of these 806 Indiana bats are expected to be injured or killed by the Action. Disruption of normal behavior as a result of physical disturbance and/or habitat modification or degradation will account for the vast majority of adverse effects.

#### 2.3.2.3 Impacts to Swarming Habitats

Swarming is a sensitive period for Indiana bats. This is when mating occurs and bats are actively foraging to store sufficient fat reserves to survive winter hibernation. While all bats are volant during this period and, therefore, less likely to be killed during the felling of a tree, the removal of suitable habitat during periods of occupation will certainly result in disturbance to roosting bats and additional energy expenditures if time must be spent seeking out new roosting sites. During a period when weight gain is critical to survival, additional energy spent searching for new roost trees also results in less time for foraging, both of which could result in reduced weight gain. It can be expected that lower weight gains during fall swarming could result in

lower fitness in those stressed individuals as exhibited by reduced survival and/or reproductive success.

During the spring staging period (early to mid-April), Indiana bats are still concentrated around the hibernacula. The bats have just awoken from hibernation and have depleted fat reserves. This is also the period when the bats are preparing to migrate to their summer roosting areas. For female Indiana bats, this migration may be hundreds of miles (see Status of the Species section). Impacts to bats during this sensitive period will be minimized by placing a 1-mile buffer around all Indiana bat P1 and P2 hibernacula and a 0.5- mile buffer around all Indiana bat P3 and P4. Staging is not expected to occur beyond this buffer and negative impacts within this buffer will require project-specific review by the KFO under the Action to determine the appropriateness of the mitigation measures.

Stress associated with the removal of swarming habitat is compounded when bats are entering a WNS-infected hibernaculum. White-nose syndrome is wide-spread across the Action Area and currently uninfected sites are likely to become infected during the active period of this BO. Bats coming out of WNS-infected hibernacula likely have lower body-weights and damaged tissues compared with bats emerging from uninfected sites. These stresses are anticipated, though to a lesser extent, even when the habitat is removed while the bats are not present.

Based on the most recent (mostly 2013) winter counts conducted at known Indiana bat hibernacula, approximately 255,000 Indiana bats hibernate within the Action Area. A review of project-specific impacts associated with CMOAs executed from 2008 through mid- 2014 shows that approximately 22 percent of forested habitat removal (837.8 out of 3,811 acres) occurred within known swarming buffers. Impacts within the 10-mile swarming buffers around Priority 1 (P1) and Priority 2 (P2) hibernacula represent 16.8 percent of the total acres (656 out of 3,811), and impacts within the 5-mile buffers around Priority 3 and Priority 4 (P3&4) hibernacula represent approximately 5 percent (181.7 out of 3,811). Assuming a similar level and distribution of impacts to swarming habitat across the 10,000 acres, the Action will result in impacts to an estimated 2,200 acres (10,000 acres X 0.22 = 2,200 acres) of forested swarming habitat over a 5-year period. For simplicity, we rounded up to 17 percent for the portion of impacts occurring within P1 and P2 swarming habitats.

We use the most recent winter count data to estimate the density of Indiana bats using Action Area swarming habitats that are within 10 miles of P1 and P2 hibernacula, and within 5 miles of P3&4 hibernacula, assuming within these circles an even distribution of bats and 50 percent forest cover:

- 214,099 bats in P1 hibernacula / 1.11 million acres of associated swarming habitat = 0.193 bats/acre;
- 32,481 bats in P2 hibernacula / 2.80 million acres of associated swarming habitat = 0.0116 bats/acre; and
- 8,856 bats in P3&4 hibernacula / 1.99 million acres of associated swarming habitat = 0.00445 bats/acre.

P3&4 swarming habitats are combined due to the large number of sites and relatively low number of bats for these hibernacula. We do not combine P1 and P2 swarming habitats, because

of the large difference in potential bat density. This bat density (on a per acre basis) is applied to the acreage of swarming habitat that we assume the Action will affect (17 percent of total effects to P1 and P2; 5 percent to P3&4), described above, to estimate how many Indiana bats the Action will affect in swarming habitats (Table 1). Since the KFO has tracked impacts to P1 and P2 swarming habitats jointly, we partition the estimated 17 percent of the Action's effects between these habitats assuming that Action effects are distributed in proportion to the availability of these two types in the Action Area, as follows:

- There are 3,906,477 acres of P1 and P2 swarming habitat within the Action Area;
- There are 1,105,148 acres of P1 swarming habitat within the Action Area;
- 1,105,148 P1 ÷ 3,906,477 acres of P1 and P2 = 0.28;
- 0.28 X 0.17 X 100 = 4.76 percent P1 swarming habitat; and
- 17 – 4.76 = 12.24 percent P2 swarming habitat.

"Total Acres Affected" in Table 1 below is calculated by applying the "Anticipated Percent of Impact" to the 10,000 acres of habitat covered under the proposed CMOA program. "Estimated Bat Density" is then applied to the "Total Acres Affected" to arrive at the estimated number of "Bats Affected Over 5 Years."

**Table 1**. Estimated number of Indiana bats affected by the Action within known swarming habitats (10-mile radius around known Priority 1 and 2 hibernacula; 5-mile radius around known Priority 3 and 4 hibernacula).

| Swarming Habitat | Anticipated Percent of Impact | Total Acres Affected | Estimated Bat Density (Bats/Acre) | Bats Affected Over 5 Years |
|---|---|---|---|---|
| Priority 1 | 4.76% | 476 | 0.194 | 92 |
| Priority 2 | 12.24% | 1,224 | 0.0116 | 14 |
| Priority 3 & 4 | 5% | 500 | 0.004 | 2 |
| TOTAL | 22% | 2,200 | | 108 |

Very few, if any, of these 108 Indiana bats are expected to be injured or killed by the Action. Disruption of normal behavior as a result of physical disturbance and/or habitat modification or degradation will account for the majority of impacts.

### 2.3.2.4 Conservation Benefits

Based on the information provided in the BA, the Service finds that CMOAs will provide recovery-focused conservation benefits in addition to the minimization measures that are typically implemented through section 7 consultations. These conservation benefits will more than offset the negative impacts to the Indiana bat caused by the covered projects for the reasons discussed in the BA, which include, but are not limited to:

- Mitigation sites are generally larger than impact sites.
- Mitigation sites are strategically located to maximize benefits to the species.
- Impacts to known habitat are mitigated at a minimum of 1:1, and are most often mitigated at a ratio greater than 1:1, and going as high as 4.5:1.

- A portion of the projects providing compensatory mitigation through the CMOA process are not likely to actually result in adverse effects to forest-dwelling bats.

Cooperators in CMOAs may choose to purchase or protect known hibernacula, maternity, or swarming areas, offer other acceptable mitigation, or make a contribution to the IBCF. IBCF funds are held by the Kentucky Natural Lands Trust (KNLT), an independent non-profit land trust, and use of these funds is a collaborative effort among KNLT, the KFO, and several federal, state, and private conservation organizations that are involved with bat and/or forest conservation in Kentucky. These collaborators identify potential projects and use funds from the IBCF to achieve the following objectives: (a) winter habitat protection and management; (b) summer habitat protection, conservation, and restoration; and (c) priority forest-dwelling bat research and monitoring needs. These mitigation measures provide a recovery-focused conservation benefit for the Indiana bat by offsetting suitable habitat loss regardless of the timing of the impacts.

### 2.3.3 Interrelated and interdependent actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. The description of the Action and covered activities, specifically states that activities beyond the scope of the effects analysis on the removal of forested habitat are not part of this Action and must be addressed under a separate process for ESA compliance. Further, the Action is a voluntary process available to projects that would occur without the Action, relying on other ESA compliance processes as applicable (section 7 consultations, section 10(a)(1)(B) permits). Based on this information and the Service's review of the BA, there are no foreseeable interrelated or interdependent actions associated with this project.

## 2.4 Cumulative Effects

In the context of a consultation, cumulative effects are the effects of future state, tribal, 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, because they require separate consultation under section 7 of the Act.

Land use activities that may affect Indiana bats and that are likely to occur within the Action Area include: timber harvest, ATV recreational use, recreational use of caves, and development associated with road, residential, industrial, and agricultural development and related activities. These private actions are likely to occur within the Action Area, but the Service is unaware of any quantifiable information about the extent of private timber harvests within the Action Area, the amount of use of off-highway vehicles within the Action Area, or the amount of recreational use of caves within the Action Area. Similarly, the Service does not have any information on the amount or types of residential, industrial, or agricultural development that have or will occur within the Action Area. Therefore, the Service is unable to make any determinations or conduct any meaningful analysis of how these actions may or may not adversely and/or beneficially affect the Indiana bat. It is possible that these activities may have cumulative effects on Indiana bats and their habitat in certain situations (e.g., a private timber harvest during summer months

within an unknown maternity colony may cause adverse effects to that maternity colony). In stating this, however, we can only speculate as to the extent or severity of those effects, if any.

## 2.5 Conclusion

After reviewing the current status of the Indiana bat, the environmental baseline for the Action Area, the effects of the Action, and cumulative effects, it is the RO's biological opinion that the KFO's participation in and approval of conservation memoranda of agreement for the Indiana bat and/or northern long-eared bat, as proposed, is not likely to jeopardize the continued existence of the Indiana bat. The Action does not affect designated critical habitat for the Indiana bat; therefore, it is not likely to destroy or adversely modify critical habitat.

The Indiana bat is declining throughout its range as a result of WNS. Although the Action is not expected to reverse this decline, we have determined that the species' reproduction, numbers, and distribution will not be appreciably reduced as a result of the Action. This no jeopardy determination is supported by the Analysis for the Effects of the Action and because:

- The impacts to Indiana bats from this Action are primarily in the form of harassment. Most of the harassment is expected to result in additional energy expenditures (reduced fitness) associated with a one-time loss of habitat. Bats are expected to fully recover from this harassment within 1–2 years.
- Impacts to maternity colonies and their reproductive success are anticipated to be short-term (2–3 years) and would only affect a small proportion on the range-wide population.
- Impacts to the species reproduction and numbers will be limited by the avoidance and minimization measures implemented by the Strategy (e.g., exclusion of hibernacula, restrictions on tree removal during the non-volant and spring staging periods, and within close proximity to hibernacula).
- No reduction in the distribution of the species is expected as the Action Area occurs near the center of the species' range, and impacts from the Action are limited at both at the project and programmatic scales, and are dispersed across a large Action Area.

Further, the conservation benefits provided by the Action are expected to promote the survival and recovery of the species through activities that include, but are not limited to:

- Protecting and managing known priority hibernacula.
- Protecting and managing existing forested habitat that support known maternity and swarming Indiana bat populations, particularly those that would expand existing conservation ownerships.
- Protecting and managing additional conservation lands that contain potential habitat for the species, particularly those that would expand existing conservation ownerships.
- Funding priority research and monitoring activities that support the conservation and recovery of the species.

## 2.6 Incidental Take Statement

Section 9 of the ESA and Federal regulations under section 4(d) of the Act prohibit the taking 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 where it actually kills or injures wildlife by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. 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 prohibited under the ESA, provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the KFO so that they become binding conditions of any grant, contract, or permit issued to an applicant, contractor, or permittee for the exemption in section 7(o)(2) to apply. The KFO has the continuing duty to regulate the activity covered by this Incidental Take Statement. If the KFO: (a) fails to assume and implement the terms and conditions; or (b) fails to require an applicant, contractor, or permittee to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the grant, contract, or permit document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the KFO must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement.

### 2.6.1 Amount or Extent of Take Anticipated

The level of incidental taking anticipated in this BO resulting from projects implemented under CMOAs between the KFO and the respective project proponent(s) is not more than 914 Indiana bats. This taking is expected in the form of harm and/or harassment. The mechanisms of this taking and the basis for our estimation of its extent are described in section 2.3 (Effects of the Action) of this BO. In summary, harm will occur when removing or altering roosting habitat directly kills or injures a bat, or impairs breeding, feeding or sheltering behavior to the extent that a bat does not survive or reproduce. Harassment will occur when removing or altering habitat and other project-related disturbances significantly disrupts breeding, feeding, or sheltering behavior creating the likelihood of reduced fitness or reproductive success. Harassment effects will occur when bats are present during project activities, or later in time when bats return to habitat altered during their absence and must reform a colony in a new location or otherwise adapt to new conditions. Except for the rare circumstance of felling trees while individuals, especially non-volant pups, are roosting in those trees, most of the Indiana bats affected will experience sub-lethal forms of harassment taking.

| SPECIES | INDIVIDUALS | TAKE TYPE |
|---|---|---|
| *Myotis sodalis* | 914 | Harm and Harass; some small indeterminable portion will be harm but most take will be from harassment. |

The Service anticipates the incidental taking of Indiana bats associated with CMOA projects will be difficult to detect for the following reasons:

- The individuals are small, mostly nocturnal, and when not hibernating, occupy forested habitats where they are difficult to observe;
- The species forms small (i.e., 25–100 individuals) maternity colonies under loose bark or in the cavities of trees, and males and non-reproductive females may roost individually, which makes finding roost trees difficult;
- Finding dead or injured specimens during or following project implementation is unlikely; and
- Most incidental take is in the form of non-lethal harassment and not directly observable.

Due to the difficulty of detecting take of Indiana bats caused by the proposed Action, the Service will monitor the extent of taking using the acreage of suitable habitat that CMOA projects remove or alter, which is up to 10,000 acres over a 5-year period, with no more than 2,000 acres occurring in any calendar year. This surrogate measure is appropriate because all anticipated taking will result from habitat removal/alteration and activities associated with that alteration, and because it sets a clear standard for determining when the extent of taking is exceeded.

### 2.6.2 Effect of the Take

In this BO, the RO has determined that the anticipated level of incidental take is not likely to jeopardize the continued existence of the Indiana bat.

### 2.6.3 Reasonable and Prudent Measures

The RO believes that the conservation measures included in the proposed Action (described in section 1.4 of this BO) are sufficient to minimize take of the Indiana bat. Therefore, the only reasonable and prudent measure that is necessary or appropriate at this time pertains to take monitoring as required under 50 CFR §402.14(i)(3).

1. The KFO will ensure that the extent of incidental take, as measured by the surrogate acres of suitable forested Indiana bat habitat, caused by projects undertaken by Federal and non-federal entities who participate in voluntary CMOAs for those projects with the KFO does not exceed 2,000 acres annually and 10,000 acres cumulatively during the 5 years following the signature date of this BO.

### 2.6.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the KFO must comply with the following Terms and Conditions, which carry out the Reasonable and Prudent Measures described above by describing monitoring and reporting requirements. These Terms and Conditions are non-discretionary.

1. The KFO shall keep records of the levels of incidental take exempted under this BO that are applied to CMOAs. These records shall track the acres of habitat affected under each agreement and specify whether the affected habitat is known summer habitat, presumed summer habitat, or swarming habitat. The KFO shall periodically audit projects implemented by CMOA cooperators to verify compliance with the Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky and the CMOA. The selection of projects for these audits is at the KFO's discretion, but shall occur at least once each year of the duration of this BO.
2. The KFO, its cooperators, and any of their contractors (CMOA parties) must take care when handling dead or injured Indiana bats or any other federally listed species that are found at CMOA project sites in order to preserve biological material in the best possible state and to protect the handler from exposure to diseases, such as rabies. CMOA parties are responsible for ensuring that evidence for determining the cause of death or injury is not unnecessarily disturbed. Reporting the discovery of dead or injured listed species is required in all cases to enable the Service to determine whether the level of incidental take exempted by this BO is exceeded and to ensure that the terms and conditions are appropriate and effective. Parties finding a dead, injured, or sick specimen of any endangered or threatened species, must promptly notify the Service's Division of Law Enforcement at 1875 Century Blvd., Suite 380, Atlanta, Georgia 30345 (Telephone: 404/679-7057) and the KFO at 330 West Broadway, Room 265, Frankfort, Kentucky 40601 (Telephone: 502/695-0468). The KFO is then responsible for notifying the RO Ecological Services program office at 1875 Century Boulevard, Suite 200, Atlanta, Georgia 30345 (Telephone 404/679-7085).

The Reasonable and Prudent Measures, with their Terms and Conditions, are designed to minimize the impact of incidental taking. The Service believes that no more than 914 Indiana bats will be incidentally taken, mostly by harassment, as a result of the Action on no more than 10,000 acres of potential and known forest habitat within the Action Area over the next 5 years, and on no more than 2,000 acres during any calendar year. If, during the course of the action, this level of habitat alteration (leading to incidental take) is exceeded, such incidental take represents new information requiring a reinitiation of consultation and review of the Reasonable and Prudent Measures provided. The KFO must immediately provide an explanation of the causes of the taking and review with the RO the need for revising the Reasonable and Prudent Measures.

# 3 Northern Long-Eared Bat

The following sections are summarized from the BA; please refer to the BA for a more information.

## 3.1 Status of the Species/Critical Habitat

The Service published its decision to list the northern long-eared bat as a threatened species on April 2, 2015 (80 FR 17974-18033). The effective date of this final rule is May 4, 2015. Critical habitat has not been proposed for the northern long-eared bat.

### 3.1.1 Species Description

The northern long-eared bat (*Myotis septentrionalis*) is a medium-sized bat species, weighing an average 5 to 8 grams, with females tending to be slightly larger than males (Caceres and Pybus 1997). Pelage colors include medium to dark brown fur on its back; dark brown, but not black, ears and wing membranes; and tawny to pale-brown fur on the ventral side (Nagorsen and Brigham 1993, as cited in USFWS 2013; Whitaker and Mumford 2009). As indicated by its common name, the northern long-eared bat is distinguished from other Myotis species by its large ears, that average 17 mm (Whitaker and Mumford 2009) and, when laid forward, extend beyond the nose but less than 5 mm beyond the muzzle (Caceres and Barclay 2000). The tragus (ear cartilage) is long (averaging 9mm), pointed, and often curved (Nagorsen and Brigham 1993, as cited in USFWS 2013; Whitaker and Mumford 2009).

### 3.1.2 Life History

*Life Cycle*
The northern long-eared bat is a migratory bat, hibernating in caves and mines in the winter (typically October through April) and migrating to summer habitat. While the northern long-eared bat is not considered a long distance migratory species, short migratory movements between summer roost and winter hibernacula covering between to 56 km (34.8 mi) and 88.5 km (55 mi) have been documented (Nagorsen and Brigham 1993, as cited in USFWS 2013; Griffith 1945). In general, northern long-eared bats arrive at hibernacula in August or September, enter hibernation in October and November, and leave the hibernacula in March or April (Caire et al. 1979; Whitaker and Hamilton 1998; Amelon and Burhans 2006). The spring migration period likely runs from mid-March to mid-May, with females giving birth (parturition) in late May or early June (Caire et al. 1979; Easterla 1968; Whitaker and Mumford 2009). However, parturition may occur as late as July (Whitaker and Mumford 2009). Fall migration likely occurs between mid-August and mid-October.

*Longevity*
Adult longevity is estimated to be up to 18.5 years (Hall et al. 1957). Most mortality for northern long-eared and many other species of bats occurs during the juvenile stage (Caceres and Pybus 1997).

*Reproduction*
Northern long-eared bats typically breed from late July in northern regions to early October in southern regions. Breeding commences when males begin to swarm hibernacula and initiate copulation activity (Whitaker and Hamilton 1998; Whitaker and Mumford 2009; Caceres and Barclay 2000; Amelon and Burhans 2006). Copulation occasionally occurs again in the spring (Racey 1982). Hibernating females store sperm and delay fertilization until spring (Racey 1979; Caceres and Pybus 1997). Ovulation takes place at the time of emergence from the hibernaculum, followed by fertilization of a single egg, resulting in a single embryo (Cope and Humphrey 1972; Caceres and Pybus 1997; Caceres and Barclay 2000); gestation is approximately 60 days (Kurta 1995, as cited in USFWS 2013). Males are reproductively inactive until late July, with testes descending in most males during August and September (Caire et al. 1979; Amelon and Burhans 2006).

Maternity colonies, consisting of females and pups, are generally small, numbering from about 30 (Whitaker and Mumford 2009) to 60 individuals (Caceres and Barclay 2000), but may be larger. Lactating northern long-eared bats have been shown to roost higher in taller trees situated in areas of relatively less canopy cover and tree density (Garroway and Broders 2008). Parturition likely occurs in late May or early June (Caire et al. 1979; Easterla 1968; Whitaker and Mumford 2009), but may occur as late as July (Whitaker and Mumford 2009).

### 3.1.3 Habitat Characteristics and Use

*Winter*

Northern long-eared bats will typically hibernate between mid-fall through mid-spring each year. Suitable winter habitat (hibernacula) for the northern long-eared bat includes underground caves and cave-like structures (e.g., abandoned or active mines, railroad tunnels). These hibernacula typically have large passages with significant cracks and crevices for roosting. Microclimate preferences for northern long-eared bats are similar to Indiana bats and include relatively constant, cool temperatures (0–9 degrees Celsius), high humidity, and minimal air currents. Specific areas where they hibernate have very high humidity, so much so that droplets of water are often seen on their fur. Within hibernacula, surveyors find them in small crevices or cracks, often with only the nose and ears visible. Anecdotal reports not yet formally documented indicate northern long-eared bats may occupy landscape features besides caves and mines during the winter (Mike Armstrong, pers. comm. 2014).

*Summer*

The northern long-eared bat typically occupies its summer habitat from mid-May through mid-August each year. During summer, northern long-eared bats roost singly or in colonies underneath bark or in cavities, crevices, or hollows of both live and dead trees and/or snags. Studies have found tree roost selection to differ slightly between male and female northern long-eared bats, with males more readily using smaller diameter trees for roosting than females, suggesting males are more flexible in roost selection than females (Lacki and Schwierjohann 2001; Broders and Forbes 2004; Perry and Thill 2007). Males and non-reproductive females may also roost in cooler places, such as caves and mines.

Northern long-eared bats switch roosts often (Sasse and Pekins 1996), typically every 2–3 days (Foster and Kurta 1999; Owen et al. 2002; Carter and Feldhamer 2005; Timpone et al. 2010). A 2004 study by Jackson tracked 30 northern long-eared bats over two years and found the mean number of different roost used by each bat to be 8.6 (range 2–11), suggesting that the species probably needs multiple suitable roosts within relatively close proximity.

The home range for northern long-eared bats may vary by sex. Broders et al. (2006) found home ranges of females to be larger than males. Northern long-eared bats are often found roosting in intact, cluttered, interior (Broders et al. 2006; Henderson et al. 2008) and older (Carter and Feldhamer 2005; Lacki and Schwierjohann 2001; Perry and Thill 2007) forests. Roost selection is likely adaptable and variable depending on forest characteristics (Ford et al. 2006). Northern long-eared bats readily exploited alterations to forest structure, likely due to enlargement of existing or creation of new canopy gaps (Johnson et al. 2009).

*Foraging Behavior*
The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, and beetles (Nagorsen and Brigham 1993, as cited in USFWS 2013; Brack and Whitaker 2001; Griffith and Gates 1985), with diet composition differing geographically and seasonally (Brack and Whitaker 2001). Foraging techniques include hawking and gleaning, in conjunction with passive acoustic cues (Nagorsen and Brigham 1993, as cited in USFWS 2013; Ratcliffe and Dawson 2003). Northern long-eared bats seem to focus foraging in upland mature forests (Caceres and Pybus 1997), with occasional foraging over forest clearings, water, and along roads (van Zyll de Jong 1985). However, most foraging occurs on forested hillsides and ridges, rather than along riparian areas (Brack and Whitaker 2001; LaVal et al. 1977). This coincides with data indicating that mature forests are an important habitat type for foraging northern long-eared bats (Caceres and Pybus 1997). Like most bats, the northern long-eared bat forages primarily at night and during twilight hours.

### 3.1.3 Status and Distribution

The northern long-eared bat is found in the United States from Maine to North Carolina on the Atlantic Coast, westward to eastern Oklahoma and north through the Dakotas, even reaching into eastern Montana and Wyoming. In Canada it is found from the Atlantic Coast westward to the southern Yukon Territory and eastern British Columbia. Historically, the species has been found in greater abundance in the northeast and portions of the Midwest and Southeast, and has been more rarely encountered along the western edge of the range.

*Current Distribution and Abundance*
The northern long-eared bat ranges across much of the eastern and north central United States (U.S.), and all Canadian provinces west to the southern Northwest Territories and eastern British Columbia (Nagorsen and Brigham 1993, as cited in USFWS 2013; Caceres and Pybus 1997). Historically, the species has been most frequently observed in the northeastern U.S. and in the Canadian Provinces of Quebec and Ontario, with sightings increasing during swarming and hibernation (Caceres and Barclay 2000). However, throughout the majority of the species' range it is patchily distributed, and historically was less common in the western portions of the range (Amelon and Burhans 2006).

Although they are typically found in low numbers in inconspicuous roosts, most records of northern long-eared bats have been from winter hibernacula surveys (Caceres and Pybus 1997). More than 780 hibernacula have been identified throughout the species range in the United States, although many hibernacula contain only a few (1–3) individuals (Whitaker and Hamilton 1998). They are typically found roosting in small crevices or cracks on cave or mine walls or ceilings and, thus, are easily overlooked during surveys and usually observed in small numbers (Griffin 1940; Caire et al. 1979; Van Zyll de Jong 1985; Caceres and Pybus 1997;).

### 3.1.4 Threats -- White-Nose Syndrome

White- nose- syndrome is currently thought to be the predominant threat to the species. For general information on white-nose syndrome, please see the Threats: White-nose syndrome section above under the Status of the Species for the Indiana bat, or visit https://www.whitenosesyndrome.org/. This section focuses on the threat of WNS to the northern long-eared bat.

Due to WNS, the northern long-eared bat has experienced a sharp decline in the northeastern part of its range, as evidenced in hibernacula surveys. Researchers consider the northeastern U.S. very close to saturation for the disease, with the northern long-eared bat being one of the species most severely affected by the disease (Herzog and Reynolds 2012). Turner et al. (2011) compared the most recent pre-WNS count to the most recent post-WNS count for 6 cave bat species, including the northern long-eared bat. Turner et al. (2011) reported a 98 percent decline between pre- and post-WNS in the number of hibernating northern long-eared bats at 30 hibernacula in New York, Pennsylvania, Vermont, Virginia, and West Virginia. Data analyzed in this study were limited to sites with confirmed WNS mortality for at least 2 years and sites with comparable survey effort across pre and post-WNS years. In hibernacula surveys in New York, Vermont, Connecticut, and Massachusetts, Langwig et al. (2012) reported larger declines in hibernacula with larger pre-WNS populations of northern long-eared bats, suggesting a density-dependent decline due to WNS. Although some species' populations stabilized at drastically reduced levels compared to pre-WNS (e.g., tri-colored bat, Indiana bat), each of the 14 populations of northern long-eared bats Langwig et al. (2012) evaluated became locally extinct within 2 years due to the disease, and were not yet re-established 5 years post-WNS.

However, by favoring small cracks or crevices in cave ceilings, which makes the species more challenging to locate during hibernacula surveys, hibernacula data in some states (particularly those with a greater number caves with more cracks or crevices) may not give an entirely clear picture of the level of decline the species is experiencing (Turner et al. 2011). When dramatic declines due to WNS occur, the overall rate of decline appears to vary by site. Some sites experience the progression from the detection of a few bats with visible fungus to wide-spread mortality after a few weeks and at other sites after a year or more (Turner et al. 2011).

Long-term (i.e., including pre- and post-WNS) summer data for the northern long-eared bat (e.g., mist-net and fall swarm trapping, maternity colony records) is somewhat limited, because the species has become one of conservation concern primarily due to the impact of WNS. However, the data that does exist corroborates the population decline observed in hibernacula surveys (Silvis et al 2015; Francl et al. 2012; Ford et al. 2011).

Although the northern long-eared bat is known to awaken from a state of torpor sporadically throughout the winter and move between hibernacula (Griffin 1940; Whitaker and Rissler 1992; Caceres and Barclay 2000), they have not been observed roosting regularly outside of caves and mines during the winter compared with other species that are less susceptible to WNS (e.g., big brown bat). Northern long-eared bats roost in areas within hibernacula that have higher humidity, possibly leading to higher rates of infection, as Langwig et al. (2012) found with Indiana bats. Also, northern long-eared bats prefer temperatures within hibernacula that range from 0 to 9 degrees C (32 to 48 degrees F) (Raesly and Gates 1987; Caceres and Pybus 1997;

Brack 2007), which are within the optimal growth limits of *G. destructans* (the fungus that causes WNS) (5 to 10 degrees C (41 to 50 degrees F)) (Blehert et al. 2009). The northern long-eared bat may also spend more time in hibernacula than other species that are less susceptible to WNS (e.g., eastern small-footed bat), which allows more time for the fungus to infect and grow on bats. Northern long-eared bats enter the cave or mine in October or November (although they may enter as early as August) and leave the hibernaculum in March or April (Caire et al. 1979; Whitaker and Hamilton 1998; Amelon and Burhans 2006). Furthermore, the northern long-eared bat occasionally roosts in clusters and often in the same hibernacula as other bat species that are also susceptible to WNS, which may increase their susceptibility to bat-to-bat transmission of WNS.

### 3.2 Environmental Baseline

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the northern long-eared bat, its habitat, and ecosystem within the Action Area. The environmental baseline is a "snapshot" of the species' health in the Action Area at the time of the consultation, and does not include the effects of the action under review.

#### 3.2.1 Status of the Species within the Action Area

The final listing rule for the northern long-eared bat divides the U.S. portion of the species' range into four parts: eastern, midwest, southern, and western (80 FR 17976). Kentucky is considered part of the southern population of the species. Records for the northern long-eared bat occur statewide but are concentrated in the eastern part of the state where the greatest survey effort has occurred. Outside of a few research projects, most northern long-eared bat summer capture records came from Indiana bat presence/absence surveys. Many of the known hibernacula are sites where winter surveys were conducted for other listed bat species such as the Indiana bat, gray bat (*Myotis grisescens*), and Virginia big-eared bat (*Corynorhinus townsendii virginianus*).

Kentucky has 119 known northern long-eared bat hibernacula (80 FR 17976) and several potential hibernacula. Most of the hibernacula have winter counts of less than 10 northern long-eared bats. This number is likely misleading though, since northern long-eared bats roost singly and often tucked up in small cracks and crevices, making accurate winter counts difficult (USFWS 2013). Consequently, reliable population numbers are not available for the northern long-eared bat within its range or within the Action Area. Further, the Service finds it likely than many more hibernacula exist across the Action Area than are currently known. Because hibernacula counts do not yield reliable population numbers for northern long-eared bats like they do for other bat species (e.g., Indiana bat), the Service is unable to estimate a population size for this species within the Action Area using hibernation data.

During the summer months, the northern long-eared bat has been considered relatively common within Kentucky. While the northern long-eared bat was consistently the third-most commonly captured bat during summer mist-net surveys, its overall percentage of captures has declined, averaging about 20.4 percent of total captures from 2006 to 2012 and only 11.6 percent in 2013 (KDFWR 2013, unpublished data). Silvis et al. (2015) found significant reductions in summer

northern long-eared bat populations at the Fort Knox Military Installation, presumably due to WNS.

Reviewing Indiana bat summer presence / probable absence surveys after the arrival of WNS (2011–2014), the Service found that the percentage of the survey sites in Kentucky that yielded northern long-eared bat captures fell dramatically following the confirmation of WNS in the state. In 2011, 40 percent of survey sites captured northern long-eared bats; this has fallen consistently over subsequent years to less than 7 percent of sites capturing northern long-eared bats in 2014. Using the most recent two years of summer presence / probable absence data (2013–2014) from surveys for the Indiana bat within Kentucky, we estimate an average occupancy rate of 14 percent for the northern long-eared bat in the Commonwealth. We attempted to use this occupancy rate to estimate a likely summer population across the Action Area, but consider the result too unreliable to have utility due the broad extrapolation from very limited data.

Within Kentucky, there have been more than 7,000 individual capture records for the northern long-eared bat, representing approximately 1,500 unique locations. For summer captures (May 15 – August 15), an evaluation of these data found a high degree of overlap between summer maternity (juveniles and reproductive females) and non-maternity (adult male and non-reproductive adult females) records. This is both with maternity and non-maternity captures at the same net site and non-maternity records falling within mapped known maternity areas. Out of 1,825 non-maternity summer captures, 94 percent (or 1,712) fell within a maternity area. The average distance between a non-maternity capture record and a maternity capture was 0.59 miles. For about 1,200 of these records, maternity and non-maternity captures occurred at the same location (KFO, unpublished data). While we do not know whether or how non-reproductive adults interact with maternity colonies, there is a strong correlation between maternity and non-maternity capture records that indicates concurrent usage of known habitat areas.

### 3.2.2 Factors Affecting Species Environment within the Action Area

It is difficult to identify specific factors affecting the species environment within the Action Area, because the Action Area has been defined as the Commonwealth of Kentucky and all portions of adjoining states that occur within 20 miles of the Kentucky border. Further, this BO is based on analysis at a programmatic level rather than at an individual project scale. However, we are able to determine that there are a number of current and long-term land uses and demographic trends which could affect northern long-eared bats within the Action Area.

*Forest Loss and Fragmentation*

Unlike most winter sites, summer habitat for northern long-eared bats is typically not static. It changes over time in its location, quality, and quantity, and is influenced by changes in land use, management, and forest structure. These changes are natural or driven by human influence. Based on the similarities between Kentucky and the Action Area that were previously discussed in the “Action area” section of this opinion, the Service considers the following discussion of forest loss and fragmentation in Kentucky as representative of trends across the Action Area.

Forest loss and fragmentation have significant impacts on the location, quality, and quantity of available summer habitat. The Kentucky Division of Forestry has identified forest loss and fragmentation as key threats to Kentucky's forests (KDF 2010). In the early 1900's, forest loss was primarily due to agricultural conversion; today surface mining and urban sprawl are driving the loss (KDF 2010). However, as some forest is lost, other land is becoming forested. This is evidenced by the relative stability of Kentucky's forested land use over the last fifty 50 years, which has consistently been just below 50 percent (Oswalt 2012). However, this is across the state and local trends vary.

Fragmentation is already a significant detriment to Kentucky's forest health. Although nearly half the state is forested, less than 14percent of these 12.4 million acres are forest interior (KDF 2010). Within large forest tracts of 1,000 or more acres, 50percent of the forest is considered edge habitat (300 foot buffer), 22 percent is small forest interior (less than 1,000 acres) and 28percent is large forest interior (greater than 1,000 acres). This may be a significant habitat use factor for northern long-eared bats which seem to prefer intact forest (Owen et. al 2003; Patriquin and Barclay 2003; Broders et. al 2006).

Forest loss and fragmentation can have significant impacts on northern long-eared bats particularly at the local level. Any increase in conversion of forested land to agricultural and/or developed lands can be expected to further fragment and eliminate forested blocks of habitat that could be used by northern long-eared bats. The extent to which this effect will be offset by new forest regeneration is unknown; any regenerated forest will typically require decades before it becomes suitable roosting habitat. These habitat loss and degradation trends can be expected to receive increased scrutiny as protection of important summer habitat becomes a critical aspect of the species' recovery following the population declines due to white-nose syndrome (Johnson et al. 2012).

*White-nose Syndrome*

A general overview of white-nose syndrome (WNS) and its effects on bat populations was previously provided in the section on the Status of the Species. This section will focus on its effects within the Action Area.

At the end of the 2013–2014 hibernacula monitoring season, 72 WNS-infected sites had been discovered in Kentucky, which includes all sites monitored in Kentucky for their bat populations. Of these 72, 60 are hibernation sites for northern long-eared bats (KDFWR 2014, unpublished data). Mortality at infected sites first became apparent in 2013, with an increase in observed mortality in 2014. To date, nine northern long-eared bats have been found dead due to WNS.

KDFWR has pre- and post-WNS trend data for 14 infected northern long-eared bat hibernacula. Northern long-eared bats are showing population declines at 10 of the 14 sites. Three sites showed population increases following the arrival of WNS and one showed no change. Declines and increases should be viewed in the context of the natural variability of northern long-eared bat hibernacula counts and the typically low numbers observed (e.g., decline from 2 to 1 individual is a 50 percent decline). Consequently, it is difficult to predict what the long-term implications of WNS are for northern long-eared bat populations within the Action Area.

*Other Factors*
Numerous land use activities that could impact northern long-eared bats and that likely occur within the Action Area include: timber harvest, ATV recreational use, recreational use of caves, underground and surface coal and limestone mining, gas production, and development associated with road, residential, industrial and agricultural development and related activities. These private actions are likely to occur within the Action Area, but the Service is unaware of any quantifiable information relating to these factors. Therefore, the Service is unable to make any determinations or conduct any meaningful analysis of how these actions may or may not adversely and/or beneficially affect northern long-eared bats. All we can say is that it is possible that these activities, when they occur, may have direct, indirect, and/or cumulative effects on northern long-eared bats and their habitats in certain situations (e.g., a private timber harvest during summer months within an unknown maternity colony may cause adverse effects to that maternity colony.). In stating this, however, we can only speculate as to the extent or severity of those effects, if any.

## 3.3 Effects of the Action

This section addresses the direct and indirect effects of the Action on the northern long-eared bat, including the effects of interrelated and interdependent activities. Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the proposed action, but are later in time and reasonably certain to occur.

### 3.3.1 Factors Considered

Our analysis considered the following factors:

- Proximity of the action – We describe known species locations and designated critical habitat in relation to the Action Area.
- Distribution – We describe where the Action will occur and the likely impacts of the activities.
- Timing – We describe the likely effects in relation to sensitive periods of the species' lifecycle.
- Nature of the effects – We describe how the effects of the action may be manifested in elements of a species' lifecycle, population size or variability, or distribution, and how individual animals may be affected.
- Duration – We describe whether the effects are short-term, long-term, or permanent.
- Disturbance frequency – We describe how the Action will be implemented in terms of the number of events per unit of time.
- Disturbance intensity – We describe the effect of the disturbance on a population or species.
- Disturbance severity – We describe how long we expect the adverse effects to persist and how long it would it take a population to recover.

*Proximity of the action*
The Action Area lies near the center of the range for the northern long-eared bat. Numerous records exist documenting that the species occupy summer and winter habitats within the Action

Area. Winter habitat is generally limited to the karst regions where suitable caves can be used for hibernacula, but summer habitat is widely distributed throughout the Action Area where suitable forested habitat exists. Critical habitat has not been proposed for the northern long-eared bat.

*Distribution*

The effects of the Action will vary depending on the location of the cooperator's project-specific impacts and the selected avoidance, minimization and compensation (mitigation) measure(s). Impacts associated with the implemented mitigation will typically occur in areas where northern long-eared bats are known or are expected to occur while those impacts associated with project-specific impacts will typically occur within the project footprint. However, it is certain that the Action, project-specific impacts, and mitigation measures approved under the Action will occur within the Action Area, and primarily within the boundaries of the Commonwealth of Kentucky. Incidental take exempted under the original and first revision of this action were widely distributed across the Commonwealth of Kentucky with occasional clusters of impacts near areas of new development where Indiana bats were known to be present. The first two iterations of the Conservation Strategy only addressed impacts to Indiana bats, as the northern long-eared bat was not yet proposed for listing.

The positive effects associated with the selected mitigation measures will typically occur within a Recovery and Mitigation Focus Area (RMFA). As is described in the Strategy, RMFAs were chosen based on a variety of factors (e.g., known presence of northern long-eared bat populations and/or existing conservation ownership, among others) that suggest these areas have the highest likelihood of supporting northern long-eared bat summer and/or winter populations in the long-term. The convergence of the mitigation efforts from one or more projects into the RMFAs will maximize the recovery-focused conservation benefits for northern long-eared bats in Kentucky and the Action Area.

*Timing*

Adverse effects related to the timing of the Action cannot be quantified, because the projects which might trigger implementation of the Strategy are driven by unpredictable external factors (e.g., market forces). However, we expect the impacts will occur during the following sensitive periods: the maternity period (mid-April through mid-August, see Status of the Species section) and fall swarming (late-August through mid-November). Detrimental impacts during these periods are expected to result in harm and harassment of adults and pups due to the removal of roost trees, degradation of habitat, alteration of travel and foraging areas, and other indeterminable habitat-related effects. During the non-volant period (June 1 through July 31) for northern long-eared bat pups, habitat removal in known and potential maternity areas will require project-specific review and may require additional mitigation measures so that mortality of pups can be minimized or avoided.

During the spring staging period (early to mid-April), northern long-eared bats are still concentrated around the hibernacula. The bats have just awoken from hibernation with depleted fat reserves, and are preparing to migrate to their summer roosting areas. Impacts to northern long-eared bats will be minimized by placing a 0.5-mile buffer around all hibernacula. Staging is not expected to occur beyond this buffer and negative impacts within this buffer will require

project-specific review to determine the appropriateness of the mitigation measures.

Bats are most sensitive to disturbance during hibernation (mid-November through March). The Strategy does not allow adverse effects to hibernating northern long-eared bats or their hibernacula to be covered under CMOAs.

While impacts to hibernating bats and hibernacula are avoided, the removal of some potential and known forested summer and swarming habitat may occur during the hibernation period. The winter removal of forested summer and swarming habitat may have an indirect adverse effect on northern long-eared bats that use those habitats during the roosting period. The resulting impacts (e.g., alteration of normal behavior patterns) are not expected to result in the direct mortality of any northern long-eared bats. However, these impacts may degrade their habitats through the loss of potential or known roost trees, the alteration of travel and foraging areas, and other indeterminable habitat-related effects. The energetic cost to northern long-eared bats returning to altered summer habitat is not known, but may be significant, particularly for pregnant females. This cost is expected to be higher for bats returning from WNS-infected hibernacula. The result of this could be in the form of reduced reproduction, fitness, or mortality.

*Nature of the Effect*
It is likely that the Action, resulting in project-specific impacts and associated mitigation measures, will have a variety of effects on individual northern long-eared bats, maternity colonies and swarming populations. In particular, the project-specific impacts are expected to: (a) eliminate known and potential foraging and roosting habitat through removal and/or conversion of that habitat (e.g., removal of maternity roost trees, summer and swarming roost trees, and foraging habitat); (b) alter habitat (e.g., fragmentation of foraging and roosting habitats, modification of travel corridors); (c) result in alteration and/or modification of normal behaviors (e.g., reproduction effects, foraging effects, and sheltering behaviors); and (d) potentially cause the mortality and/or injury of individual bats. Further, the mitigation measures associated with the project-specific impacts are expected to result in: (a) protection of previously unprotected winter habitat, (b) protection and/or management of summer and swarming habitats, and (c) funding of priority research and monitoring needs for northern long-eared bats. Critical habitat has not been proposed for the northern long-eared bat.

*Duration*
The majority of the positive effects of the Action will be permanent, as will most of the adverse effects associated with each project-specific impact as defined within a CMOA. We expect protected lands will be protected and managed in perpetuity, and we expect that most impacts will also result in the permanent loss of forested northern long-eared bat habitat. However, there may be project-specific actions that only temporarily affect forested bat habitat. These would include forest management projects where forest stands are managed, thinned or allowed to regenerate over time and may have both adverse and beneficial effects to northern long-eared bats.

*Disturbance Frequency*
The frequency at which project-specific impacts are implemented and associated impacts occur cannot be accurately determined. While the disturbance frequency cannot be determined, the

amount of habitat that could be impacted on an annual basis is limited to 2,000 acres per species. Further, individual projects can only disturb up to 100 acres of suitable habitat. Based on these limits, and assuming that these maximum limits actually occur, there could be as few as 20 projects annually affecting each species. However, as individual project acreages decline, the number of projects causing adverse effects per year can increase. While we have historically seen less than 100 projects per year and the majority of projects small in acreage (under 10 acres), the disturbance frequency cannot be predicted with accuracy because the KFO does not control the implementation of project-specific impacts.

*Disturbance Intensity*

The intensity of the disturbance is difficult to estimate, because we do not know how much of the habitat that may be removed is occupied by bats, nor do we know the density of northern long-eared bats using these areas. While the Action will result in some incidental take of northern long-eared bats, mostly in the form of harassment, we believe that under most circumstances, harassed bats will occupy similar habitats within the Action Area without significant reductions in population size (see Status of the Species and Environmental Baseline). The Action (up to 10,000 acres) will affect less than 0.05 percent of the habitat available within the Action Area (20,961,171 acres) over its five year duration and less than 0.01 percent of available forested habitat in a given year (0.05 percent ÷ 5 years = 0.01 percent per year). Please see the Analysis of Effects for a more detailed assessment of disturbance intensity.

*Disturbance Severity*

The KFO has deliberately restricted the project-specific impacts that can be implemented under the executed CMOAs in order to limit the severity of disturbance to northern long-eared bats. This is accomplished by excluding projects that impact hibernacula and by requiring project-specific evaluations for those impacts that exceed 100 acres, occur in known maternity areas during the period when pups are non-volant (June 1 through July 31), or occur in sensitive area such as the 0.5- mile radius surrounding all northern long-eared bat hibernacula. These minimization measures reduce the disturbance severity of the Action by identifying disturbances that would likely have an increased level of adverse effect and either excluding them from this process or requiring project-specific evaluations of the proposed impacts. For those projects that are accepted for inclusion in the Action but which also require project-specific reviews, additional mitigation measures may be required, as appropriate, in the CMOA. Additional mitigation measures may include, but are not limited to: increased habitat replacement ratios, intensive searches to identify potential roost trees so that those can be avoided if they contain pups, use of different approaches or equipment to remove habitat, etc. However, these will be necessitated by site-specific information and factors available at that time and cannot be accurately analyzed at this time.

In most cases, it is unlikely that a project will result in the immediate death of an individual bat; most adverse effects will be related to the reduced fitness of bats due to increases in energy expenditure as the result of behavioral modification due to the loss of roost trees, foraging areas, and/or travel corridors. In these situations, we it is anticipated that, based on the wide availability of suitable habitat within the Action Area, the affected bats will be able to shift to other primary and secondary or alternate roost trees. The loss of a northern long-eared bat maternity colony's complete roosting range would the most severe effect which could occur

from projects implemented under the Action. By restricting projects to 100 acres or less, it is unlikely that an entire home range would be lost but roosting ranges are much smaller and could be eliminated by a single project of 100 or fewer acres. However, Silvis et al. (2014) found it likely that a maternity colony would reform in such situations based on the species documented fidelity to home ranges over multiple years.

### 3.3.2 Analysis for Effects of the Action

Private and Federal entities who enter CMOAs with the KFO agree to implement the mitigation measures described in the Strategy. These measures are part of the effects that CMOA projects have on northern long-eared bats and their habitats. Projects implemented under CMOAs may adversely affect northern long-eared bats by removing or altering their roosting habitat. In addition to roosting habitat loss, projects may cause a decrease in the quality of habitat remaining within the Action Area, including increased habitat fragmentation, loss of foraging areas, loss of travel corridors, increased disturbance, and other forms of habitat degradation. The following sections describe the general effects of projects covered under CMOAs and are summarized from the BA; please refer to the BA for more information.

#### 3.3.2.1 Impacts to Summer Habitats

During the non-hibernation seasons, northern long-eared bats, especially females, often roost in live, damaged, and/or dead trees. It is the physical condition of the tree, not the tree species, which make these trees suitable for roosting. Stochastic events, such as lightning strikes or pest outbreaks, and other disturbances create and distribute trees in this condition within forested tracts and across the available forestlands.

Northern long-eared bat maternity colonies occur throughout the state. There is a dense cluster of maternity records in the eastern coalfields), likely due to the large amount of forested land and the high level of survey effort for Indiana bats in this area associated with the permitting process for surface coal mining. Historically, the northern long-eared bat has been one of the most commonly captured species during summer mist-net surveys in Kentucky. Data compiled by the KFO shows that of the 1,825 non-maternity summer captures of northern long-eared bats in Kentucky (adult males and non-reproductive females), approximately 94 percent (1,712) occurred within three miles of a northern long-eared bat maternity capture record. It is unknown how non-reproductive adult northern long-eared bats interact with maternity colonies, but the strong correlation between maternity and non-maternity capture records indicates concurrent usage of an area. Based on this strong correlation between maternity and non-maternity captures, the KFO concludes it is appropriate to treat all summer (May 15–August 15) captures as indicative of maternity usage. Further, the KFO believes that there are more maternity colonies within the Action Area than are documented (known), therefore any project impacting suitable northern long-eared bat maternity habitat (where probable absence has not been demonstrated) is considered to have the potential to impact maternity colonies.

*Habitat Removal – Summer*
Summer habitat for northern long-eared bats occurs throughout Kentucky and project-specific impacts implemented under the Action may occur anywhere within the Action Area. Impacts to

summer habitat may occur during periods of occupation by northern long-eared bats (April 1 through August 15) or during periods when the habitat is unoccupied. In most cases, the death of an individual bat from summer habitat removal would require the bat to be present in the specific tree being removed at the time it is felled. Further, the bat must be struck either during the felling or the subsequent fall of the tree. If not struck during the felling, volant bats would likely have the opportunity to escape the falling tree. The probability that all of these factors would occur, combined with the minimization measure requiring project-specific analysis during the non-volant period, results in a correspondingly low probability of death of an individual northern long-eared bat.

The most common adverse effect associated with the removal of summer habitat will be the harassment of bats that are disturbed from their roost(s), abandoning higher quality habitat in order to distance themselves from the disturbance;, and loss of suitable roosting, foraging, and/or travel habitat. This harassment is not limited to the periods when the bats are present at the impact sites. The loss of suitable summer habitat during the period of inoccupation (i.e., while the bats are hibernating) cannot be discounted for this action. Northern long-eared bats returning to summer roosting areas have low fat reserves after hibernation and migration. Further, the females are pregnant which increases their energy needs. Habitat removal results in increased habitat fragmentation, loss of foraging areas and travel corridors. The degradation of these habitats will harass northern long-eared bats that are presumably stressed already by causing them to expend additional time and energy reserves finding suitable roosting habitat and/or roosting in trees that may be inferior to the roost trees that have been removed, thus resulting in decreased fitness and recruitment.

This is exacerbated for bats that have survived hibernation in a white-nose syndrome (WNS) infected environment. A review of summer capture data by Francl et al. (2012) before and after the arrival of WNS in West Virginia found a decline in capture rates for Indiana and northern long-eared bats following the arrival of WNS. For northern long-eared bats, there was also a decline in the proportion of juvenile captures later in the survey season, indicating reduced reproductive success following WNS.

*Habitat Removal - Maternity*

Northern long-eared bat known maternity colonies appear to be more prevalent in the heavily forested eastern portion of Kentucky than in other areas. However, this portion of the state has also received much greater survey effort (for Indiana bats), associated with the permitting requirements for surface coal mining activities. While this predominance of maternity colonies in the eastern coalfields may be influenced by the level of survey effort, it also correlates well with the reported preference of northern long-eared bats for foraging and roosting in interior forests as compared with forest edges and more open habitats (Owen et al. 2003, Patriquin and Barclay 2003).

Adverse effects to northern long-eared bats from the removal of maternity habitat may occur as described under section 4.3.2.1.2 of the BA on the effects of summer habitat removal. However, the removal of maternity roosting habitat between June 1 and July 31, while the pups are non-volant, is when the likelihood of mortality is highest. Project-specific review is required for all projects within known or potential maternity habitat that would occur during this timeframe. In

most cases, CMOA projects will not result in the removal of suitable habitat during that timeframe, in order to minimize the negative impacts to maternity colonies. However, there could be limited situations when project-specific evaluations determine that the proposed project is unlikely to result in the high levels of mortality because suitable maternity roosts are not proposed to be removed or emergence counts have been conducted to determine that the potential roosts trees are not used at that time.

While the loss of an occupied primary maternity roost would result in the greatest immediate impact, the loss of multiple roost trees could cause displaced individuals to expend increased levels of energy while seeking out replacement roost trees. Although the median individual project size for projects previously covered under CMOAs was less than 2 acres under this Action, impacts could be as large as 100 acres. With home roosting ranges documented from less than 50 acres to over 100 acres (Lacki et al. 2009), it is possible that a project could result in the loss of all the roosts for a given maternity colony. While avoidance and minimization measures placed on projects should prevent this from occurring during the non-volant period, the loss of all maternity roosts prior to parturition could reduce the reproductive success of the colony (see previous discussion under Disturbance Severity).

If increased energy expenditure occurred during a sensitive period of a bat's reproductive cycle (e.g., pregnancy), it is possible that spontaneous abortion or other stress-related reproductive delays or losses in fecundity may be a likely response in some individuals, particularly those that may have already been under other environmental stresses (e.g., WNS). The Service has hypothesized that these stresses and delays in reproduction could also cause lower fat reserves and ultimately lead to lower winter survival rates (USFWS 2002). For example, females that may have pups with lower birth weights or their pups may have delayed development rates (i.e., late into the summer). This could, in turn, affect the overwinter survival of these young-of-the-year bats if they enter fall migration and winter hibernation periods with inadequate fat reserves. These stresses are anticipated, though to a lesser extent, even when the habitat is removed when the bats are not present.

Northern long-eared bats are routinely captured during Indiana bat summer presence / probable absence surveys. Looking at only the two most recent post-WNS years (2013–2014), the Service found that 14 percent of survey sites (44 out of 315) in Kentucky yielded northern long-eared bat captures. Assuming that 14 percent of the 10,000 acres proposed for impact contain northern long-eared bat maternity colonies and that each maternity colony requires 161 acres (Owens et al. 2003), the Service estimates that 8.7 northern long-eared bat maternity colonies could be adversely affected by the Action over a 5-year period. These 8.7 maternity colonies represent approximately 783 northern long-eared bats, assuming the mid-point of 30–60 adult females per colony, and that each produces 1 juvenile (45 adult females + 45 pups = 90 bats) (USFWS 2014b):

- 10,000 acres X 0.14 occupancy rate = 1,400 acres
- 1,400 acres ÷ 161 acres per colony = 8.7 colonies
- 8.7 colonies X 90 bats per colony = 783 bats

### 3.3.2.2 Impacts to Swarming Habitats

There are 119 known northern long-eared bat hibernacula within Kentucky (80 FR 17976). The Strategy specifically excludes impacts to caves and other potential hibernacula. In addition to avoiding impacts to hibernacula, the KFO has identified those areas within a 0.5-mile radius around all northern long-eared bat hibernacula as sensitive and requires project-specific coordination with the KFO to determine if the proposed project is appropriate for coverage under a CMOA.

Swarming is a sensitive period for northern long-eared bats. This is when mating occurs and when bats are busy foraging to store sufficient fat reserves to survive winter hibernation. While all bats are volant during this period and, therefore, less likely to be killed during the felling of a tree, the removal of suitable habitat during periods of occupation will certainly result in disturbance to roosting bats and additional energy expenditures if time must be spent seeking out new roosting sites. During a period when weight gain is critical to survival, additional energy spent searching for new roost trees also results in less time for foraging, both of which could result in reduced weight gain. It can be expected that lower weight gains during fall swarming could result in lower fitness in those stressed individuals as exhibited by reduced survival and/or reproductive success.

Stress associated with the removal of swarming habitat is compounded when bats are entering a white-nose syndrome infected hibernaculum. White-nose syndrome is wide-spread across the Action Area and currently uninfected sites are likely to become infected during the active period of this BO. Bats coming out of WNS-infected hibernacula likely have lower body-weights and damaged tissues compared with bats emerging from uninfected sites.

These impacts will be minimized through the use of the Strategy which requires individual review of projects with impacts within 0.5-mile of all northern long-eared bat hibernacula. During the spring staging period (early to mid-April), northern long-eared bats are still concentrated around the hibernacula. The bats have just awoken from hibernation and have depleted fat reserves. This is also the period when the bats are preparing to migrate to their summer roosting areas. Impacts to bats during this sensitive period will be minimized by placing a 0.5- mile buffer around all northern long-eared bat hibernacula. Staging is not expected to occur beyond this buffer and negative impacts within this buffer will require project-specific review by the KFO under the Action to determine the appropriateness of the mitigation measures.

As discussed in the Status of the Species and Environmental Baseline, northern long-eared bats are difficult to detect during winter surveys and the Service expects that many hibernacula are unknown. To be conservative and consider a larger effect on the species than is likely to occur, the Service has chosen to assume that all of the projects implemented under CMOAs will impact northern long-eared bat swarming populations. The Service is also assuming that each 5-mile swarming buffer contains 100 northern long-eared bats. This is likely a high estimate considering that most winter counts within the Action Area detect fewer than 10 northern long-eared bats per hibernaculum. However, a high estimate accounts for additional impacts to currently undocumented swarming populations. Using these assumptions to calculate a density for swarming habitat and applying that density to the 10,000 acres impacted by the Action, the

Service anticipates that up to 20 northern long-eared bats will be adversely affected by the Action's impacts to northern long-eared bat swarming habitat:

- 5-mile radius around a hibernacula encompasses 50,266 acres;
    - $A = \pi r^2$ = 3.14159 X (5 miles)$^2$ = 75.54 miles$^2$
    - 75.54 miles$^2$ X 640 acres/mile$^2$ = 50,266 acres
- 100 bats ÷ 50,266 acres = 0.002 bats per acre; and
- 10,000 acres X 0.002 bats per acre = 20 bats.

### 3.3.3 Interrelated and interdependent actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. The description of the Action and covered activities, specifically states that activities beyond the scope of the effects analysis on the removal of forested habitat are not part of the Action and must be addressed under a separate process for ESA compliance. Further, the Action is a voluntary process available to projects that would occur without the Action, relying on other ESA compliance processes as applicable (i.e., section 7 consultations, section 10(a)(1)(B) permits). Based on this information and the Service's review of the BA, there are no foreseeable interrelated or interdependent actions associated with this project.

## 3.4 Cumulative Effects

In the context of a consultation, cumulative effects are the effects of future state, tribal, 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, because they require separate consultation under section 7 of the Act.

Land use activities that may affect northern long-eared bats and are likely occur within the Action Area include: timber harvest, ATV recreational use, recreational use of caves, and development associated with road, residential, industrial, and agricultural development and related activities. These private actions are likely to occur within the Action Area, but the KFO is unaware of any quantifiable information about the extent of private timber harvests within the Action Area, the amount of use of off-highway vehicles within the Action Area, or the amount of recreational use of caves within the Action Area. Similarly, the KFO does not have any information on the amount or types of residential, industrial, or agricultural development that have or will occur within the Action Area. Therefore, the KFO is unable to make any determinations or conduct any meaningful analysis of how these actions may or may not adversely and/or beneficially affect the northern long-eared bat. It is possible that these activities may have cumulative effects on northern long-eared bats and their habitat in certain situations (e.g., a private timber harvest during summer months within an unknown maternity colony may cause adverse effects to that maternity colony). In stating this, however, we can only speculate as to the extent or severity of those effects, if any.

### 3.5 Conclusion

After reviewing the current status of the northern long-eared bat, the environmental baseline for the Action Area, the effects of the Action and cumulative effects, it is the RO's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the northern long-eared bat. No critical habitat has been proposed for this species; therefore, none will be affected.

The northern long-eared bat is declining throughout its range as a result of WNS. Although the Action is not expected to reverse this decline, we have determined that the species' reproduction, numbers, and distribution will not be appreciably reduced as a result of the Action. This no jeopardy determination is supported by the Analysis for the Effects of the Action and because:

- Impacts to the species reproduction and numbers will be limited by the avoidance and minimization measures implemented by the Strategy (e.g., exclusion of hibernacula, restrictions on tree removal during the non-volant and spring staging periods, and within close proximity to hibernacula).
- The impacts to northern long-eared bats from this Action are primarily in the form of harassment. Most of the harassment is expected to result in additional energy expenditures (reduced fitness) associated with a one-time loss of habitat. Bats are expected to fully recover from this harassment within 1–2 years.
- Impacts to maternity colonies and their reproductive success are anticipated to be short-term (2–3 years) and would only affect a small proportion on the range-wide population.
- No reduction in the distribution of the species is expected as the Action Area occurs near the center of the species' range, and impacts from the Action are limited at both at the project and programmatic scales, and are dispersed across a large Action Area

Further, the conservation benefits provided by the Action are expected to promote the survival and recovery of the species through activities that include, but are not limited to:

- Protecting and managing known priority hibernacula.
- Protecting and managing existing forested habitat that support known maternity and swarming northern long-eared bat populations, particularly those that would expand existing conservation ownerships.
- Protecting and managing additional conservation lands that contain potential habitat for the species, particularly those that would expand existing conservation ownerships.
- Funding priority research and monitoring activities that support the conservation and recovery of the species.

### 3.6 Incidental Take Statement

Section 9 of the ESA and Federal regulations under section 4(d) of the Act prohibit the taking 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 where it actually kills or injures wildlife by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. 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 prohibited under the ESA, provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the KFO so that they become binding conditions of any grant, contract, or permit issued to an applicant, contractor, or permittee for the exemption in section 7(o)(2) to apply. The KFO has the continuing duty to regulate the activity covered by this Incidental Take Statement. If the KFO: (a) fails to assume and implement the terms and conditions; or (b) fails to require an applicant, contractor, or permittee to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the grant, contract, or permit document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Service must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement.

### 3.6.1 Amount or Extent of Take Anticipated

The level of incidental taking anticipated in this BO resulting from projects implemented under CMOAs between the KFO and the respective project proponent(s) is not more than 803 northern long-eared bats. This taking is expected in the form of harm and/or harassment. The mechanisms of this taking and the basis for our estimation of its extent are described in section 3.3 (Effects of the Action) of this BO. In summary, harm will occur when removing or altering roosting habitat directly kills or injures a bat, or impairs breeding, feeding or sheltering behavior to the extent that a bat does not survive or reproduce. Harassment will occur when removing or altering habitat and other project-related disturbances significantly disrupts breeding, feeding, or sheltering behavior creating the likelihood of reduced fitness or reproductive success. Harassment effects will occur when bats are present during project activities, or later in time when bats return to habitat altered during their absence and must reform a colony in a new location or otherwise adapt to new conditions. Except for the rare circumstance of felling trees while individuals, especially non-volant pups, are roosting in those trees, most of the northern long-eared bats affected will experience sub-lethal forms of harassment taking.

| SPECIES | INDIVIDUALS | TAKE TYPE |
|---|---|---|
| *Myotis septentrionalis* | 803 | Harm and Harass; some small indeterminable portion will be harm but most take will be from harassment. |

The Service anticipates the incidental taking of northern long-eared bats associated with CMOA projects will be difficult to detect for the following reasons:

- The individuals are small, mostly nocturnal, and when not hibernating, occupy forested habitats where they are difficult to observe;
- The species forms small (i.e., 30–60 individuals) maternity colonies under loose bark or in the cavities of trees, and males and non-reproductive females may roost individually, which makes finding roost trees difficult;
- Finding dead or injured specimens during or following project implementation is unlikely; and
- Most incidental take is in the form of non-lethal harassment and not directly observable.

Due to the difficulty of detecting take of northern long-eared bats caused by the proposed Action, the Service will monitor the extent of taking using the acreage of suitable habitat that CMOA projects remove or alter, which is up to 10,000 acres over a 5-year period, with no more than 2,000 acres occurring in any calendar year. This surrogate measure is appropriate because all anticipated taking will result from habitat removal/alteration and activities associated with that alteration, and because it sets a clear standard for determining when the extent of taking is exceeded.

### 3.6.2 Effect of the Take

In this BO, the RO has determined that the anticipated level of incidental take is not likely to jeopardize the continued existence of the northern long-eared bat.

### 3.6.3 Reasonable and Prudent Measures

The RO believes that the conservation measures included in the proposed Action (described in section 1.4 of this BO) are sufficient to minimize take of the northern long-eared bat. Therefore, the only reasonable and prudent measure that is necessary or appropriate at this time pertains to take monitoring as required under 50 CFR §402.14(i)(3).

1. The KFO will ensure that the extent of incidental take, as measured by the surrogate acres of suitable forested northern long-eared bat habitat, caused by projects undertaken by Federal and non-federal entities who participate in voluntary CMOAs for those projects with the KFO does not exceed 2,000 acres annually and 10,000 acres cumulatively during the 5 years following the signature date of this BO.

### 3.6.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the KFO must comply with the following Terms and Conditions, which carry out the Reasonable and Prudent Measure described above by describing monitoring and reporting requirements. These Terms and Conditions are non-discretionary.

1. The KFO shall keep records of the levels of incidental take exempted under this BO that are applied to CMOAs. These records shall track the acres of habitat affected under each agreement and specify whether the affected habitat is known summer habitat, presumed summer habitat, or swarming habitat.
2. The KFO shall periodically audit projects implemented by CMOA cooperators to verify compliance with the Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky and the CMOA. The selection of projects for these audits is at the KFO's discretion, but shall occur at least once each year of the duration of this BO.
3. The KFO, its cooperators, and any of their contractors (CMOA parties) must take care when handling dead or injured northern long-eared bats or any other federally listed species that are found at CMOA project sites in order to preserve biological material in the best possible state and to protect the handler from exposure to diseases, such as rabies. CMOA parties are responsible for ensuring that evidence for determining the cause of death or injury is not unnecessarily disturbed. Reporting the discovery of dead or injured listed species is required in all cases to enable the Service to determine whether the level of incidental take exempted by this BO is exceeded and to ensure that the terms and conditions are appropriate and effective. Parties finding a dead, injured, or sick specimen of any endangered or threatened species, must promptly notify the Service's Division of Law Enforcement at 1875 Century Blvd., Suite 380, Atlanta, Georgia 30345 (Telephone: 404/679-7057) and the KFO at 330 West Broadway, Room 265, Frankfort, Kentucky 40601 (Telephone: 502/695-0468). The KFO is then responsible for notifying the RO Ecological Services program office at 1875 Century Boulevard, Suite 200, Atlanta, Georgia 30345 (Telephone 404/679-7085).

The Reasonable and Prudent Measures, with their Terms and Conditions, are designed to minimize the impact of incidental taking. The Service believes that no more than 803 northern long-eared bats will be incidentally taken, mostly by harassment, as a result of the Action on no more than 10,000 acres of potential and known forest habitat within the Action Area over the next 5 years, and on no more than 2,000 acres during any calendar year. If, during the course of the action, this level of habitat alteration (leading to incidental take) is exceeded, such incidental take represents new information requiring a reinitiation of consultation and review of the Reasonable and Prudent Measures provided. The KFO must immediately provide an explanation of the causes of the taking and review with the RO the need for revising the Reasonable and Prudent Measures.

# 4 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the Act by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to minimize or avoid the adverse effects of a proposed action, implement recovery plans, or develop information useful for the conservation of listed species. The RO offers the following conservation recommendations:

1. The KFO should keep records of the amount of habitat purchased, managed, and protected and the amount of funding contributed to the Imperiled Bat Conservation Fund. The KFO should use these records, and other information about conservation benefits to bats resulting

from the CMOA program, to inform an analysis of its overall effect in determining whether to renew and modify the program as the duration of the current program draws to a close.

2. The KFO should create a geographic data base and query tool that allows CMOA cooperators to identify when proposed projects are located within known Indiana and/or northern long-eared bat habitat. The KFO should update this data base at least annually.

# 5 Reinitiation Notice

This concludes formal consultation on the KFO's participation in and approval of voluntary Conservation Agreements and their effects on Indiana and/or northern long-eared bats. Reinitiation of formal consultation is required where discretionary KFO involvement or control over the action has been retained (or is authorized by law) and if: (a) the amount or extent of incidental take is exceeded, (b) new information reveals effects of the KFO's action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation, (c) the KFO's action is later modified in a manner that causes an effect to the listed species or critical habitat not considered in this consultation, or (d) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

For this BO, the exempted incidental take would be exceeded when the take surpasses 2,000 acres of Indiana bat habitat removal or 2,000 acres of northern long-eared bat habitat removal in any year for a 5-year period. The total amount of incidental take, as measured by the habitat surrogate, covered for this period is 10,000 acres for each species. These are the amounts of habitat removal that are exempted from the prohibitions of section 9 of the Act by this BO.

This consultation was assigned FWS ID # 04E00000-2015-F-0005. Please refer to this number in any correspondence concerning this consultation.

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Roby, Piper. 2014. Copperhead Consulting, Inc. Personal Communication.

## Appendix A: Summary of Past Incidental Take (Indiana bat)

| PROJECTS | SERVICE OFFICE AND DATE BO ISSUED | INCIDENTAL TAKE (IT) FORM | TAKE EXEMPTED or SURROGATE MEASURE TO MONITOR |
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| Installation of Cave Gates at Mammoth Cave National Park, Kentucky | Ashville FO October 1980 | N/A | None |
| Construction of Solvent Refined Coal Demo Project in Daviess County, Kentucky | Ashville FO March 1981 | N/A | None |
| Installation of Cave Gates at New Mammoth Cave, Tennessee | Ashville FO August 1982 | N/A | None |
| Three Miles of New Transmission Line, Big Rivers Wescor, Kentucky | Ashville FO June 1983 | N/A | None |
| Short Creek Stream Channelization Project, Kentucky | Ashville FO July 1983 | N/A | None |
| Construction of a New Navigation Lock, Kentucky River | Tennessee FO March 1991 | N/A | None |
| State Route 32 Improvement Project, Claiborne and Grainger Counties,Tennessee | Tennessee FO May 1993 | N/A | None |
| Construction of Potable Water Distribution System, Jackson County, Kentucky | Tennessee FO May 1994 | N/A | None |
| 1996 Programmatic Biological Opinion for Surface Coal Mining Regulatory Programs Under the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87) | Washington DC September 1996 | IT by harm, harassment, and killing of all current and future listed species | Unquantifiable |

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| Cherokee National Forest LRMP; Note: As a result of new information, this Forest is now operating under a "not likely to adversely affect" determination, and this BO is no longer in effect. | Tennessee FO January 1997 | IT by killing harming or harassing | 1,300 acres annually |
| Spillway Rehabilitation at Tippy Dam, MI | East Lansing FO January 1997 | IT by harming, harassing, or killing | 3-65 individuals |
| Relocation of US Army Chemical School & US Military Police School to Fort Leonard Wood, Missouri | Missouri FO | IT by harming, harassing, or killing | 56 hibernating bats from fog oil and TPA smoke pots; summer bats difficult to determine sublethal take |
| Daniel Boone National Forest LRMP; Note: This BO has been superseded by a March 2004 BO. | Tennessee FO April 1997 | IT by killing, harming, or harassing | 4,500 acres annually |
| Ozark-St. Francis National Forest LRMP; | Arkansas FO June 25, 1998 | IT by killing, harming or harassing | Annually 8,000 acres of timber harvest in hardwoods, 11,000 acres harvest of pine and pine/hardwoods; 30,000 acres of prescribed burning |
| Construction of New Training Facilities at Fort Knox, KY | Tennessee FO October 1998 | IT by killing, harming or harassing | 2,000 acres |
| Construction of a Qualification Training Range at Fort Knox, KY | Tennessee FO October 1998 | IT by killing, harming or harassing | 80 acres |
| Construction & operation of the Multi-purpose training Range at the Camp Atterbury Army National Guard Training Site-Edinburgh Indiana NOTE: Superseded by November 2000 Amendment | Indiana FO December 4, 1998 | IT by harm through habitat loss and exposure to toxic agents | 1 maternity colony (200 bats total) and 99.7 ha of forest |
| Disposition of Lands Acquired by the Tennessee Valley Authority for the Columbia Dam Project, Maury County, Tennessee | Tennessee FO March 1999 | No take provided | No take provided |

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| Proposed stream bank stabilization at Yano Range and upgrade of the Wilcox Tank Range at Fort Knox, KY | Tennessee FO April 1999 | IT by loss of summer roosting, foraging, and maternity habitat | 1800 acres; 2 maternity colonies |
| Agricultural Pesticide Application Practices at Newport Chemical Depot, Newport IN | Indiana FO April 13, 1999 | IT by harm through exposure to pesticides | 2 maternity colonies with 74 bats total |
| Ouachita National Forest LRMP; Note: As a result of new information, this Forest is now operating under a "not likely to adversely affect" determination, and this BO is no longer in effect | Arkansas FO April 26, 1999 | IT by killing, harming or harassing | Annually up to: 40,000 acres commercial harvest; 3,000 acres wildlife management & road construction/ reconstruction; 24,000 acres thinning; 200,000 acres prescribed burning |
| Mark Twain National Forest LRMP; Note: This BO has been superseded by the September 2005 BO | Missouri FO June 23, 1999 | IT by killing, harming, or harassing | Timber harvest – 20,000 acres per year; Prescribed fire - 12,000 acres/yr; Wildlife habitat improvement -2000 acres/yr; Timber stand improvement – 4000 acres/yr; Soil & water improvement – 150 acres/yr; Range management – 50 acres/yr; Mineral exploration & development – 50 acres/yr; Wildfire fire lines – 50 acres/yr; Special use – 50 acres/yr; Road construction – 25 acres/yr |
| Impacts of Forest Management and Other Activities to the Bald Eagle, Indiana Bat, Clubshell and Northern Riffleshell on the Allegheny National Forest, Pennsylvania; Note: As a result of new information, this Forest is now operating under a "not likely to adversely affect" determination, and this BO is no longer in effect. | Pennsylvania FO June 1999 | IT by killing, harming, or harassing | Within a 5-year period (1999 to 2003), the disturbance of 45,594 acres |

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| National Forests in Alabama; Note: As a result of new information, this Forest is now operating under a "not likely to adversely affect" determination, and this BO is no longer in effect. | Alabama FO December 10, 1999 | IT by killing, harming or harassing | No more than 100 trees |
| Supplement for Proposed Bridges & Alignments Modifications to Kentucky Lock Addition Project | Tennessee FO January 2000 | IT by killing, harming or harassing | No more than 20% of available suitable habitat |
| Green Mountain National Forest LRMP; Note: As a result of new information, this Forest is now operating under a "not likely to adversely affect" determination, and this BO is no longer in effect. | New England FO 2000 | IT by harming or harassing | 300 acres annually |
| White Mountain National Forest LRMP; Note: As a result of new information, this Forest is now operating under a "not likely to adversely affect" determination, and this BO is no longer in effect. | New England FO 2000 | IT by harming or harassing | 1,500 acres |
| Nantahala and Pisgah National Forests LRMP Amendment #5 Superseded by February 2009 Amendment | Asheville (NC) FO April 2000 | IT by killing, harming, or harassing | 4,574 acres per year |
| Daniel Boone National Forest LRMP and the Proposed Special Habitat Needs and Silviculture Amendment | Tennessee FO May 2000 | No take provided | No take provided |
| Hazard Tree Removal and Vegetation Management Program at Mammoth Cave National Park | Tennessee FO June 2000 | IT by loss of roosting habitat, direct mortality or by forcing bats to abandon tree | No take provided |
| Salvage Harvest Necessitated by 1998 Storm Damage on the Daniel Boone National Forest | Tennessee FO July 2000 | IT by killing, harming, or harassing | 3,100 acres |

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| Revised: Construction & operation of the Multi-purpose training Range at the Camp Atterbury Army National Guard Training Site- Edinburgh Indiana | Indiana FO November 2000 | IT by harm through habitat loss and exposure to toxic agents | 121 ha of forest |
| North East research Station – Fernow Experimental Forest – Five year plan NOTE: Superseded by the December 2005 BO | West Virginia FO November 2000 | IT by potential harm or mortality of roosting bats | 42 acres timber harvest and 95 acres prescribed burn |
| Bankhead National Forest; Modification of 1999 BO for National Forests in Alabama | Alabama FO January 23, 2001 | IT by killing, harming or harassing | Level of take changed for southern pine beetle suppression areas – upper limit of 65 suitable roost trees |
| Hoosier National Forest LRMP; Note: This BO has been superseded by a January 2006 BO. | Indiana FO June 13, 2001 | IT by harm | Pine clear cuts – 578 acres; Pine shelterwood cuts – 391 acres; Pine thinning – 408 acres; Hardwood group selection cuts – 777 acres; HW single tree selection cuts – 100 acres; HW even aged salvage cuts – 518 acres; Prescribed fire treatment – 7000 acres; Forest openings maintenance – 3311 acres; Timber stand improvement – 2264 acres; Special use permits – 286 acres; Wildfire management – 250 acres; road construction – 16 acres; hazard tree removal – 100 trees; trail construction – 15 miles |
| Wayne National Forest LRMP; Note: BO has been superseded by a November 2005 BO. | Ohio FO September 20, 2001 | IT by harm | Permanent loss of habitat – 2,504 acres; Habitat alteration – 8,102 acres plus 125 trees |
| Ozark-St. Francis National Forest Prescribed Fire Plan (an amendment to June 1998 LRMP BO). | Arkansas FO March 21, 2002 | IT by loss of roost trees and potential roost trees | Prescribed fire - 153,000 acres/yr |
| 1986 (as amended) Monongahela National Forest Land and Resource Management Plan (Forest Plan); Note – This BO has been superseded by a July 2006 BO. | West Virginia FO March 2002 | IT by killing, harming, or harassing | A maximum of 6,125 acres annually and prescribed burning on a maximum of 300 acres annually. |

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| BO for the Six Points Road interchange and Associated Development | Indiana FO March 2002 | IT by killing, harming, or harassing | 139 ha of roosting and foraging habitat (includes: 149 reproductive females & young; unquantifiable number of adult males and un-reproductive females) |
| Huron-Manistee National Forest LRMP; Note: This BO has been superseded by a March 2006 BO. | Michigan FO June 13, 2003 | IT by killing, harming, or harassing | 0-65 bats; 3,150 ac (1,275 ha) of potential Indiana bat habitat may be harvested and 2,648 ac (1,071 ha) of habitat may be burned for fire management or wildlife habitat management activities for the duration of this proposed action |
| Great Smoky Mountains National Park Prescribed Burning | Tennessee FO August 12, 2003 | IT by loss of suitable roosting or foraging habitat | One maternity colony |
| Big Monon Ditch Reconstruction Project | Indiana FO August 5, 2003 | IT by harming and harassing | Permanent loss of 75 acres of occupied summer habitat |
| Proposed Construction, Operation, and Maintenance of Alternative 3C of Interstate 69 from Indianapolis to Evansville NOE: This has been replaced by a 2006 revised BO | Indiana FO December 3, 2003 | IT by harming, killing | Summer Action Area: permanent direct & indirect loss of up to 1527 acres of forested habitat and 40 acres of non-forested wetlands. Winter Action Area: permanent loss of up to 947 acres of forest habitat around 10 known hibernacula. Death by vehicle collisions: 10 Indiana bats per year. |
| 2003 Revised Jefferson National Forest Land and Resource Management Plan, Virginia, West Virginia, Kentucky | Virginia FO January 2004 | IT by killing, harming, or harassing | 16,800 acres total (15,000 fire; 1,800 other habitat manipulations) per year |
| Reinitiation: Wayne National Forest LRMP NOTE: Superseded by November 2005 BO | Ohio FO March 8, 2004 | IT by harm | Additional 11,892 acres of habitat alteration |
| 2004 Daniel Boone National Forest Revised LRMP Note: BO has been superseded by an April 2007 BO. | Kentucky FO March 20, 2004 | IT by killing, harming, or harassing | Green tree harvest – 4000 acres; Salvage/sanitation – 350 acres; Prescribed burning during summer – 50,000 acres |

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| Upper Mississippi River – Illinois Waterway System Navigation Feasibility Study | Rock Island (IL) FO August 2004 | IT by injury, death, harming or harassing | 511 acres of forested habitat annually for 50 years. Less than 20 bats per year. |
| Impacts of the Laxare East and Black Castle Contour Coal Mine Projects on the Indiana bat<br>NOTE: BO has been superseded by the 2006 revised BO | West Virginia FO February 2005 | IT by killing, harm and harassment | No more than 40 adult females & their pups; permanent loss of 2199 acres forested habitat; 917 acres of habitat fragmentation and degradation; 11.95 miles of stream loss |
| Department of the Army 88th Regional Readiness Command, US Army Reserve Center | Ohio FO April 14, 2005 | IT by harming or harassing | 18 acres of high quality roosting and foraging habitat |
| Construction, Operation, and Maintenance of the U.S. 33 Nelsonville Bypass | Ohio FO April 15, 2005 | IT by harming, death, injury | No more than 10 Indiana bats |
| Mark Twain National Forest 2005 Forest Plan, Missouri; Note: Replaces June 1999 BO. | Missouri FO September 2005 | IT through removal of roost trees | 10 occupied roost trees , 19,400 acres and 240 miles of fire line over 10 years; |
| Construction .Operation, and Maintenance of the US 24 New Haven, Indiana to Defiance, OH Project | Ohio FO September 30, 2005 | IT by harming, harassing, and killing | Not to exceed 10 individuals |
| BO on the Interstate 69 (I-69) preferred alternative #2 from Henderson, Kentucky to Evansville, Indiana, and its effects on the Indiana bat; Henderson County, Kentucky and Vanderburgh County, Indiana | Kentucky FO October 2005 | IT through harm, harassment, and/or mortality | The level of take authorized is for those wooded areas of occupied and/or potentially occupied Indiana bat habitat within the construction limits of the proposed project that lie within the Indiana bat focus area identified in the BA, which was determined to be about 28 acres of wooded habitat and all of the potential Indiana bat roost trees contained within those 28 acres. |
| Wayne National Forest Land and Resource Management Plan; Note: Replaces March 2004 BO. | Ohio FO November 2005 | IT through removal of roost trees | No more than 4 occupied roost trees will be incidentally taken over the next ten years; Permanent Road Construction & Reconstruction -392 acres; Temporary Road Construction -146 acres; Skid Trails and Log Landings - 740 acres; Utility Development - 50 acres; Fire Lines - 750 miles |

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| Shawnee National Forest LRMP | Illinois FO December 3, 2005 | IT through harming, harassing, and killing | First 10 Years of plan: -- 11,565 acres of timber harvest/mgt. and minerals mgt. -- 5,630 acres of timber stand improvement and wetlands mgt. Second 10 Years of plan: -- 21,255 acres of timber harvest/mgt. and minerals mgt. -- 13,289 acres of timber stand improvement and wetlands mgt. Mortality of up to 2 individuals during research and monitoring. |
| North East Research Station – Fernow Experimental Forest – Five year plan; Note: Replaced November 2000 5-year BO. | West Virginia FO December 2005 | IT by potential harm or mortality of roosting bats | 124 acres timber harvest and 466 acres of prescribed burns (previous 42 acres timber harvest and 54 acres prescribed burn) over 5 years |
| Final Biological Opinion on implementation of the 2003 Ice Storm Recovery Project and it effects on the Indiana bat, Morehead Ranger District, Daniel Boone National Forest, Rowan County, Kentucky | Kentucky FO December 2005 | IT through harm, harassment, and/or mortality | The level of incidental take authorized is 4,704 acres of commercial removal of damaged trees and restoration and creation of bat habitat when accomplished during the summer roosting period of the Indiana bat (April 1 to September 15). |
| Hoosier National Forest LRMP; Note: This BO replaced the June 2001 BO. | Indiana FO January 2006 | IT by injury or death or harassing | No more than four (4) occupied roost trees/year and between four (4) and twelve (12) individuals injured or killed each year. 2956-acres; 60 hazard trees; 100 "accident" trees per year |
| Huron-Manistee National Forest LRMP NOTE: Replaces 2003 BO | Michigan FO March 2006 | IT through harming, harassing, and killing | For first 10 years of revised Forest Plan: Thinning = 59,497 Clearcut = 45,144 Shelterwood = 8,261 Selection = 0 |

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| Biological Opinion – Impacts of the Laxare East and Black Castle Contour Coal Mining Projects on the Indiana bat; Note: Reinitiation of February 2005 BO. | West Virginia FO March 2006 | IT in the form of harm due to habitat loss, degradation and fragmentation, Harassment during active mining, Permanent loss of foraging loss and roosting habitat, habitat fragmentation and degradation, permanent loss of streams and their associated watering and prey base for Indiana bats, long term alteration of streams | No more than 17 adult females and their pups; 912 acres of forested habitat and 5.0 miles of stream |
| Allegheny National Forest, West Branch Tionesta Site | Pennsylvania FO April 2006 | IT through harming, harassing, and killing | 574 acres of forested habitat loss or alternation from prescribed burning |
| Hoosier National Forest's Proposed Tell City Windthrow 2004 Salvage Timber Harvest | Indiana FO April 2006 | Death and injury from direct felling of occupied trees; Harassment of roosting bats from noises/ vibrations/ disturbance levels causing roost-site abandonment and atypical exposure to day time predators while fleeing and seeking new shelter during the day-time; and Harm through the loss of primary and/or alternate roost trees | Project-wide Combined Total: 8,525 acres |
| Final Programmatic BO On Minor Road Construction Projects In Kentucky And Their Effects On The Indiana Bat | Kentucky FO June 2006 | IT through harming, harassment, mortality | The level of take authorized is for those wooded areas of Indiana bat habitat within the construction limits of a proposed project covered by Tier 2 during KYTC FY 2006 through KYTC FY 2010, which was determined to be 500 acres of Indiana bat habitat as described in the HAM in KYTC FY06, 600 acres in KYTC FY07, 720 acres in KYTC FY08, 864 acres in KYTC FY09, 1,037 acres in KYTC FY10. |

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| Programmatic Biological Opinion for the Monongahela National Forest 2006 Forest Plan Revision | West Virginia FO<br>July 2006 | IT through harming, harassment, and/or mortality | 10,052 acres of suitable Indiana bat habitat annually |
| Revised BO on the Proposed Construction, Operation, and Maintenance of Alt. 3C of Interstate 69 from Evansville to Indianapolis<br>NOTE: BO has been superseded by the 2013 Amendment 2 | Indiana FO<br>August 2006 | Death/kill and/or injury/wound from direct felling of occupied trees, direct collision with vehicles, and other sources. | 2,148 acres of forested habitat and 20 acres of non-forested wetlands within summer Action Area; 1,097 acres of forested habitat within winter Action Area; 11 individuals per year from collision with vehicles |
| Programmatic BO for the Crab Orchard National Wildlife Refuge | Illinois FO<br>August 8, 2006 | IT by harm, harass and kill | Loss of no more than 15 occupied roost trees plus up to 2 individual from research/monitoring |
| Meads Mill Project, Allegheny National Forest; USFWS Project #2006-1408 | Pennsylvania FO<br>September 2006 | IT through harm, harassment, and/or death | 549 acres of forested habitat by prescribed fire |
| BO on the Ohio DOT's Statewide Transportation Program for the Indiana bat | Ohio FO<br>January 2007 | IT through harm, harassment, and/or death | 22,118 acres of suitable Indiana bat habitat over 5 years |
| 2007 Daniel Boone National Forest Revised BO on implementation of the revised LRMP and its effects on the Indiana bat<br>Note: Replaced March 20, 2004 BO. | Kentucky FO<br>April 2007 | IT by killing, harming, or harassing | Annually: Green tree harvest – 4000 acres; Salvage/sanitation – 350 acres; Prescribed burning during summer – 50,000 acres |
| BO and ITS for Indiana bat (*Myotis sodalis*) at the Herrington Place Subdivision, Reminderville, Summit County, Ohio | Ohio FO<br>April 2007 | IT through harm, harassment, and/or death | Permanent loss of 61.7 acres high quality roosting & foraging habitat and fragmentation of suitable habitat on the 125 acre site. Mortality of 1 adult male and1 adult female |
| The Effects of the U.S. 6219, Section 019, Transportation Improvement Project (Meyersdale, Somerset County, Pennsylvania to I-68 in Garrett County, Maryland) on the Indiana bat | Pennsylvania FO<br>October 2007 | IT through harm, and/or harassment | All Indiana bats dependent on 375 acres of potential foraging and roosting habitat and near blasting/construction |

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| Final Biological Opinion on the Reconstruction of US 119 from Partridge to Oven Fork in Letcher County | Kentucky FO November 2007 | IT through harm, harass and/or death | 456 wooded acres of occupied and/or potentially occupied Indiana bat habitat within the construction limits of the proposed project |
| Biological Opinion On The USDA Forest Service Application Of Fire Retardants On National Forest System Lands | Washington DC February 2008 | No take provided | No take provided |
| Biological Opinion on the Fort Drum Connector Project, FHWA in Jefferson County, NY | New York FO June 2008 | IT through harm and mortality | Harm to a small percentage of Indiana bats within 36 acres of forest, 4,181 linear feet of hedgerow and degradation of 102 acres of forest. Mortality from road operation of less than 10 Indiana bats |
| Intra-Service Programmatic Biological Opinion on the Proposed Participation In and Approval of Conservation Memoranda of Agreement for the Indiana bat, Commonwealth of KY replaced by the January 2011 BO | Kentucky FO June 2008 | IT through harm, harassment and mortality | Up to 40,000 acres of suitable roosting and foraging habitat or travel corridors with no more than 8,000 acres in any one calendar year. |
| Biological Opinion on the Whitebreast Creek Lake and Housing Project, Osceola, Iowa | Rock Island, IL FO August 2008 | IT in the form of injury, death, harm and harassment | Removal and modification of 651 acres of suitable maternity habitat and less than 10 adult male bats per year for five years. |
| Amendment to the Terms and Conditions of the USFWS's Biological Opinion on the Potential Impacts of the Nantahala and Pisgah National Forests Land and Natural Resource Management Plan on the Indiana bat Replaces the April 2000 T&C | Ashville, NC FO February 2009 | IT by killing, harming, or harassing | 5,855 acres of habitat |

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| Biological Opinion on the Operation of Fort Drum Military Installation, Jefferson and Lewis counties, NY | New York FO June 2009 | IT in the form of harm, injury and mortality | Permanent disturbance of up to: 3,781 acres of forest (potential roosting/foraging habitat) and an additional 2,183 acres of potential foraging habitat, forest management on up to 4,900 acres of forest (potential roosting/foraging habitat). Mortality of less than 20 Indiana bats. |
| Biological Opinion on the Adams Fairacre Farms Store, Dutchess County, NY | New York FO November 2009 | IT in the form of harm | Removal of approximately 9.33 acres of forest and degradation of 3.48 acres of forest. |
| Biological Opinion for the Land Between the Lakes National Recreational Area's Wildfire and Forest Vegetation Management Program, Lyon and Trigg counties, KY | Kentucky FO January 2010 | IT in the form of mortality, harm and/or harassment | Up to 9,000 acres of wildland fire during summer roosting; 5,000 acres of wildlife fire during fall swarming, and 2,200 acres of forest management at any time of year. |
| Programmatic Biological Opinion on the Effects of Ongoing and Future Military and Land Management Activities at Camp Atterbury Joint Maneuver Training Center in Bartholomew, Brown and Johnson counties, IN | Bloomington, IN FO October 2010 | IT in the form of mortality, harm and/or harassment | The permanent loss of 209 acres of mature forested habitat, 132 acres of immature forested habitat and up to 10 exceptionally hazardous/potential roost trees per year removed between April1 and September 30. |
| Final Biological Opinion for Section 10(a)(1)(A) Activities Conducted for Federally Listed Bats in the Southeast Region | Kentucky FO December 2010 | IT in the form of mortality, harm and/or harassment | Up to 5 individuals per year injured or killed by traditional bat research activities.<br><br>Up to 10 individual per year killed by selective euthanasia associated with WNS |
| Final Revised Intra-Service Programmatic Biological Opinion on the Proposed Participation In and Approval of Conservation Memoranda of Agreement for the Indiana bat, Commonwealth of KY<br><br>Replaces the June 2008 BO | Kentucky FO January 2011 | IT through harm, harassment and mortality | All the Indiana bats on up to 12,500 acres of suitable roosting and foraging habitat or travel corridors with no more than 2,500 acres in any one year. |

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| Biological Opinion on the Effects of the Shaffer Mountain Wind Farm on the Indiana Bat. Somerset and Bedford Counties, PA | Pennsylvania FO September 2011 | IT through harm, harassment and mortality | Up to 2% of the maternity colony or ≤ 0.3 volant Indiana bats per year; and up to two adult males over the life of the project. |
| Biological Opinion on the Effect of Proposed Activities on the Fort Drum Military Installation (2012-2014). Jefferson and Lewis Counties, NY | New York FO February 2012 | IT through harm, harassment and mortality | One dead or injured Indiana bat from the wind turbine operation and harassment or mortality of a small number from smoke and obscurant operations. |
| Biological Opinion on the Application for an Incidental Take Permit for the Federally Endangered Indiana bat for the Buckeye Wind Power Project. Champaign County, OH | Ohio FO July 2012 | IT through death | 130 Indiana bats with no more than 26 per 5 year period and no more than 14.2 in any given year. |
| Biological Opinion on the Effects of Golden-Winged Warbler Habitat Creation by the Natural Resources Conservation Service on the Indiana Bat. Somerset County, PA | Pennsylvania FO December 2012 | IT through harassment | Up to 2 Indiana bats. |
| Biological Opinion on the Effects of the Programmatic Forest Management Plan for Potential Indiana bat Habitat Areas on Wildlife Management Areas for which the WV Division of Natural Resources, Wildlife Resource Section Has Forest Management Authority. | West Virginia FO February 2013 | IT through harm, harassment and mortality | Unquantifiable number of Indiana bats |
| Biological Opinion for Section 10(a)(1)(A) Permitted Activities Associated with Acoustic Deterrent and Curtailment Speed Research at the California Ridge Wind Energy Project. Champaign and Vermillion Counties, IL | Rock Island FO July 2013 | IT through harm, harassment and mortality | Up to two bats per year for three years. |
| Biological Opinion on Enbridge Pipelines (FSP) L.L.C.'s Flanagan South Pipeline Project. IL, MO, KS, OK | Midwest RO July 2013 | IT through harm, harassment and mortality | Up to 19 Indiana bats (death, harm, harass); and , up to 120 reproductive females (harm and/or harass) |

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| Amendment 2 to the Tier 1 Revised Programmatic Biological Opinion for the I-69, Evansville to Indianapolis, Indiana highway | Bloomington FO<br>July 2013 | IT through harm, harassment and mortality | 1,973 acres of forest loss resulting in the take of up to 1,068 Indiana bats.<br><br>21 Indiana bat from vehicle collision through 2030 |
| Consultation Document for the NiSource Multi-Species Habitat Conservation Plan. | USFWS Regions, 3,4,5 September 2013 | IT through harm, harassment and mortality | Up to 2,584 Indiana bat individuals estimated to be present in no more than 69,900 acres of summer and/or spring staging and/or swarming habitat. |