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Memorandum

To: Field Supervisor, Kentucky Field Office, Frankfort, KY

From: Jennifer M. Garland, Fish and Wildlife Biologist
Kentucky Field Office, Frankfort, Kentucky

Subject: Final Revised Biological Opinion: The Service's Continued Participation In and Approval of Conservation Memoranda of Agreement for the Indiana Bat (*Myotis sodalis*)

CONCUR:

Virgil Lee Andrews, Jr.
Field Supervisor
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This document transmits the Fish and Wildlife Service's (Service) final revised biological opinion based on our review of the Service's continued participation in and approval of Conservation Memoranda of Agreement (Conservation Agreements) with Federal and non-Federal entities that would provide recovery-focused conservation benefits for the Indiana bat while allowing the removal of up to 12,500 acres of known and/or potential Indiana bat habitat throughout the action area. These actions will result in adverse effects on the endangered Indiana bat (*Myotis sodalis*). This biological opinion completes the programmatic consultation on the Service's continued participation in and approval of these Conservation Agreements in accordance with section 7(a)(2) of the Act.

This final biological opinion replaces the 2008 opinion on the Service's proposed participation in Conservation Agreements for the Indiana bats and implements the following significant changes: (1) expansion of the action area to include portions of adjoining states that are within 20 miles of the Kentucky Border, (2) reduction in the swarming buffer placed around priority 3 and priority 4 Indiana bat hibernacula from ten miles to five miles, (3) reduction in the amount exempted incidental take both cumulatively and annually, and (4) a re-evaluation of the threat from white-nose syndrome. This biological opinion is based on information provided in the revised Indiana

Bat Mitigation Guidance for the Commonwealth of Kentucky that was prepared by the Kentucky Field Office, the draft, revised Indiana Bat Recovery Plan (Service 2007), and various published and unpublished documents. A complete administrative record is on file at the Kentucky Field Office.

CONSULTATION HISTORY

August 2010, the Kentucky Field Office (KFO) determined that it would be valuable to revise the programmatic biological opinion on the Service's participation in Conservation Agreements for Indiana bats prior to the September 2013 expiration date in order to make the following revisions: (1) expansion of the action area to include portions of adjoining states that are within 20 miles of the Kentucky Border, (2) reduction in the swarming buffer placed around priority 3 and priority 4 Indiana bat hibernacula from ten miles to five miles, (3) reduction in the amount exempted incidental take both cumulatively and annually, and (4) a re-evaluation of the threat from white-nose syndrome.

Fall 2010, the KFO began contacting appropriate field offices in adjacent states to explain the proposed revision and to gather information regarding known occurrences of Indiana bats within the revised action area.

November 2010, the KFO created a revised map of known Indiana bat habitat for the new action area and completed habitat availability analyses for the known maternity and swarming areas.

December 2010, the KFO began drafting the revised programmatic biological opinion for the Service's participation in and approval of conservation memoranda of agreements. Additionally, the KFO began revising the Indiana bat mitigation guidance to reflect the changes in the revised biological opinion. As the affects of the proposed action to Indiana bats were evaluated, the revised mitigation guidelines were evaluated to ensure a sufficient level of protection and conservation for the Indiana bat would be provided.

3 January 2011, the KFO finalized the revised Indiana Bat Mitigation Guidance for the Commonwealth of Kentucky

3 January 2011, the KFO issued the final revised biological opinion on the proposed action.

BIOLOGICAL OPINION

I. DESCRIPTION OF PROPOSED ACTION

Proposed Action

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

The proposed action is the Service's continued participation in and approval of an unknown number of voluntary Conservation Memoranda of Agreements (Conservation Agreements) with Federal and non-Federal entities that would provide recovery-focused conservation benefits for the Indiana bat while allowing the removal of up to 12,500 acres of known and/or potential Indiana bat habitat throughout the Commonwealth of Kentucky and extending the action area into portions of adjacent states (Missouri, Illinois, Indiana, Ohio, West Virginia, Virginia, and Tennessee) that are within 20 miles of the Kentucky border[1]. The Service views the development and implementation of the Conservation Agreements as a potential way to (a) engage the participation of a wider array of conservation partners in Indiana bat conservation and/or recovery in Kentucky and adjacent states and (b) provide authorization of Indiana bat incidental take associated with habitat-altering projects in a manner that would also yield tangible Indiana bat conservation and/or recovery benefits through implementation of various Indiana bat conservation measures. Currently, many such projects are reviewed under the normal consultation procedures of section 7(a)(2) of the Act/ESA, which promotes the avoidance and minimization of adverse effects and incidental take but does not require project proponents to provide any conservation and/or recovery benefit(s). Under the proposed approach, project proponents would have the option to enter into a Conservation Agreement with the Service that would include all three types of benefits to Indiana bats: avoidance, minimization, and added conservation and/or recovery benefits in the form of various types of mitigative conservation measures. The process established by the proposed action is supported by the April 2008 regional draft Guidance for Authorization of Incidental Take of Listed Species via Conservation Enhancement Memoranda of Agreement with Non-Federal Entities.

In order to implement this approach, the Service developed the "Indiana bat Mitigation Guidance for the Commonwealth of Kentucky" (Guidance), which was made public on June 5, 2008 along with the issuance of the original biological opinion. This Guidance was revised on May 14, 2010 to clarify terminology and to more accurately assess potential impacts to Indiana bat (Appendix

[1] Extending the action area into portions of states adjoining Kentucky is a primary objective of this revision. The addition of these areas increases the size of the action area from 40,319 square miles to 62,254 square miles, an increase of 54%.

A). This Guidance has been revised again to incorporate the changes described in this biological opinion. This revision will be made available on the date that this biological opinion is made final.

The Guidance is available for voluntary use by Federal agencies and non-Federal entities and identifies the conservation and/or recovery measures that could be undertaken by project proponents under a Conservation Agreement framework to assist in the conservation and/or recovery of the Indiana bat within the action area. These measures were identified as appropriate for use based on the priority recovery actions contained in the revised draft recovery plan (USFWS 2007), the Indiana bat location and demographic information for the action area available to the Service, and relevant Service regulations, policy, and guidance. The measures include: (1) protecting known and previously unprotected Indiana bat hibernacula, (2) protecting known and previously unprotected Indiana bat maternity and/or swarming habitat, and (3) contributing funding to the Indiana Bat Conservation Fund (IBCF) [2] sufficient to achieve identified mitigation needs if other measures are impractical or will be of limited value to Indiana bat conservation and/or recovery.

The Service expects the recovery-focused conservation benefits provided by the Conservation Agreements and Guidance to be greater than the minimization measures typically implemented during section 7 consultations in two ways. First, section 7 consultations only require minimization of adverse effects, which typically is for habitat loss that occurs during the period of occupation by Indiana bats. Most commonly, this involves the removal of suitable roosting and foraging habitat during the summer months. The Guidance supports this minimization approach but also includes provisions for mitigation of adverse effects; the minimization and mitigation measures are discussed later in this biological opinion. Second, impacts to Indiana bat summer roosting and foraging habitat were typically minimized through the use of "seasonal cutting restrictions". These seasonal cutting restrictions avoided direct impacts (e.g., mortality) to Indiana bats and these habitats by requiring project proponents to remove forested habitat during the Indiana bat's winter hibernation period (i.e., the habitat is removed while the species is not present). However, seasonal cutting restrictions do not address indirect and/or cumulative effects on the species and its summer habitat, as will be explained in greater detail later in the "Effects of the proposed action" section. The Guidance addresses these indirect and/or cumulative effects issues by ensuring that winter removal of habitat also requires mitigative conservation measures.

In executing a Conservation Agreement, the Service will ensure proper implementation of the Guidance. Conservation Agreements will outline each Cooperator's (i.e., the Service and project proponent(s)) commitments and responsibilities under the Conservation Agreement. In particular, the Conservation Agreements will outline: (a) the purpose and objectives of the Conservation Agreement, (b) the legal authority(ies) supporting the Conservation Agreement, (c) a statement of mutual interest in the conservation and recovery of the Indiana bat, (d) a description of qualifying projects, (e) the effective date and terms of the Conservation Agreement, (f) the specific obligations of the Cooperators, (g) a statement of cooperation, (h) the

[2] The Service developed the Indiana bat Conservation Fund in 2007 through a Memorandum of Agreement with the Kentucky Natural Lands Trust. A copy of this MOA, and its recent modification, is provided in Appendix B.

procedures for modification or termination of the Conservation Agreement, (i) a list of other provisions, as needed by the Cooperators, and (j) necessary information pertaining to notices and authorized representatives. However, the provisions of each Conservation Agreement will likely vary due to a variety of factors, including but not limited to, site-specific information, project schedule, the mitigation measures selected, etc. Within these provisions, the Service may choose to establish a process for deviating (either increasing or decreasing) from the mitigation ratios set forth in the Guidance. The Service will ensure that any deviation is appropriate for the impacts proposed and does not undermine the goals of the Guidance. Execution of a Conservation Agreement that includes habitat-related or other adverse effects in a neighboring state will require the advance, written approval of the Service Field Office or Field Offices involved. Such approval can be separate from the Conservation Agreement or can be acknowledged by the signature of an authorized Service employee from affected the affected Field Office or Field Offices.

Conservation Agreements will be both programmatic and project-specific in nature. Programmatic Conservation Agreements will describe routine or reoccurring project types that typically include the same or similar types of potential adverse effects to Indiana bats. For example, new highway, natural gas transmission, and electrical transmission lines are linear projects that typically involve the clearing and removal of trees and brush during construction and or right-of-way maintenance. As such, it is possible to accurately quantify potential adverse effects to Indiana bat summer habitat that can result from these project-specific impacts on an acreage basis. Therefore, the Service anticipates that programmatic Conservation Agreements can provide significant benefits to the Service and project proponents by streamlining routine or reoccurring projects and to Indiana bats by ensuring that potential impacts are quantified and conservation and/or recovery benefits are provided. Programmatic Conservation Agreements 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. As of November 30, 2010, the Service has executed one programmatic Conservation Agreement with a utility company for their right-of-way activities. This Conservation Agreement authorized up to 750 acres of incidental take per year for five years. Incidental take actually used has been significantly less – 146.6 acres over two years. The Service is in the process of developing three more programmatic Conservation Agreements that are expected to be executed after this final biological opinion is issued. Pending agreements are with the Kentucky Division of Forestry, Kentucky Division of Abandoned Mine Lands, and Sanitation District 1 in northern Kentucky.

Project-specific Conservation Agreements will be used for projects that are not routine or reoccurring (i.e., one-time impacts) where the potential adverse effects to Indiana bats can be quantified. For example, the project proponent for a residential development could enter into an Conservation Agreement if the project involves adverse effects to Indiana bat foraging and roosting habitat. The Conservation Agreement would quantify the habitat that would be adversely affected and the type(s) of conservation and/or recovery benefits that would be attained through implementation of Indiana bat conservation measures. As of December 2, 2010, the Service has entered into 76 project-specific Conservation Agreements (this includes 2 modifications) authorizing up to 1,149.49 acres of forest habitat-related incidental take.

Federal and non-federal entities that implement the Guidance in association with activities that are expected to result in adverse effects to Indiana bats will obtain authorization for any anticipated incidental take that occurs through the incidental take statement contained in this biological opinion. For federal action agencies, a Conservation Agreement, coupled with this biological opinion, will satisfy the consultation requirements under section 7(a)(2) of the Act. However, federal action agencies will not be precluded from implementing additional conservation measures or programs pursuant to section 7(a)(1) of the Act.

The Service proposes to enter into Conservation Agreements based on the Guidance and the following limitations:

1. No more than an accumulated total of all the Indiana bats within 12,500 acres (not more than 2,500 acres annually) of known and/or potential habitat are incidentally taken and/or adversely affected by the projects implemented under those Conservation Agreements,
2. for a period of 5 years and ending on January 31, 2016 or
3. if data suggests that Indiana bat populations in the Appalachian Mountains, Midwest or Ozark-Central recovery units are following similar population trajectories as the Northeast recovery unit following the arrival of WNS, whichever occurs first[3].

Determination of significance will be based on a comparison with the population trajectories documented in the Northeast hibernacula following the discovery of WNS in 2006. The Service will work with the regions and states within the action area to carefully monitor the results of winter hibernacula checks and the results of all WNS monitoring efforts. The KFO believes that this is a much more sensitive trigger than monitoring rangewide population estimates, which are produced biennially.

At that time, the Service will re-initiate formal consultation on implementation of the Conservation Agreements and Guidance to ensure that their further use will not jeopardize the continued existence of the species or adversely modify its designated critical habitat. The Service will also re-evaluate the effectiveness of the proposed action, including the Guidance, to determine if the anticipated conservation and/or recovery benefits for Indiana bats were achieved. If these evaluations determine that (a) the continued use of Conservation Agreements and implementation of the Guidance will not jeopardize the species or result in the adverse modification of designated critical habitat and (b) the implementation of the Conservation Agreements and Guidance has achieved the expected conservation and/or recovery benefits, the Service may elect to continue use of Conservation Agreements and the Guidance. If the Service

[3] The Service recognizes that the full effects of white-nose syndrome on Indiana bat populations will not be realized for some time. To be cautious in our approach to this programmatic authorization of incidental take, we have dramatically reduced the amount of take available annually from 8,000 acres to 2,500 acres and included a caveat that the Service will stop entering into Conservation Agreements and revisit the effects of this proposed action if the threat from White-nose syndrome reaches a point where the Service is concerned that jeopardy will occur through a combination of WNS-related and authorized take-related effects.. The Service looked at using the rangewide population estimates to establish a WNS but felt that this information is not released frequently enough to address the threat from WNS. Additionally, the Service considered using the arrival of WNS or the fungus, *G. destructans*, at high priority hibernacula as a trigger but due to the uncertainty surrounding the potential effects of WNS outside of the Northeast RU, we did not consider this to be an appropriate trigger either. The current WNS trigger for reinitiation is not different than the mandatory trigger

determines that the Guidance has not achieved the anticipated recovery-focused conservation benefits, the Service may terminate its use.

Action area

The Service has described the action area to include 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. This action area allows the Service to take into consideration the fact that the impacts associated with the development and approval of Conservation Agreements and the associated implementation of the Guidance: (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. The action area is also sizeable enough to provide meaningful analysis of any other direct, indirect, and cumulative effects that could result from the proposed action.

The following description of the action area focuses on existing data for Kentucky that is readily available to the public. The Service believes that this is an appropriate approach for this action area as those portions of adjacent states included in the action area are very similar to the adjoining portion(s) of Kentucky. This is supported by an analysis of land cover within Kentucky and within the action area using the 2001 National Land Cover Data set.

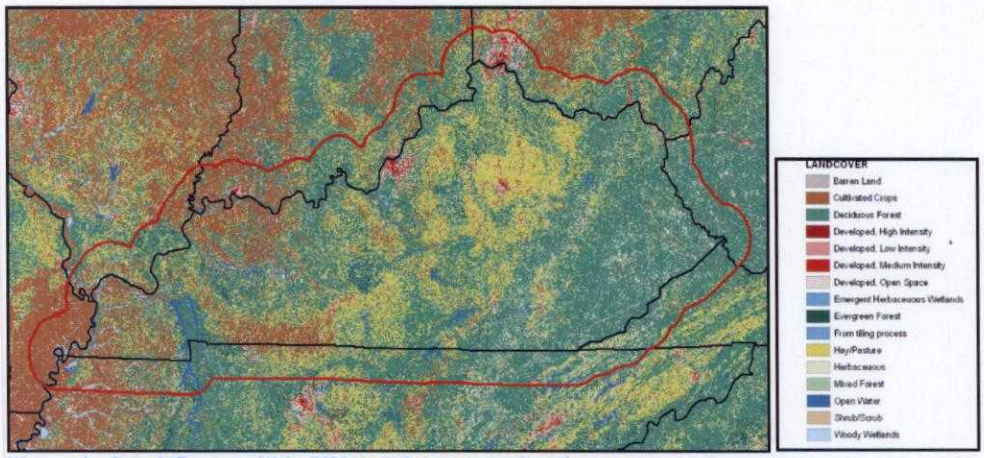

Figure 1: Land Cover within KY and the proposed action area.

Table 1: Comparison of land cover within action area and Kentucky.

Land Use Type	% of Action Area	% of Kentucky	Difference
Open Water	1.87	1.68	0.18
Developed, Open Land	5.11	4.96	0.15
Developed, Low Intensity	1.58	1.41	0.17
Developed, Medium Intensity	0.59	0.52	0.07
Developed, High Intensity	0.21	0.19	0.02
Barren Land	0.29	0.29	0
Deciduous Forest	48.33	48.55	-0.22
Evergreen Forest	1.99	2.06	-0.07
Mixed Forest	1.75	1.86	-0.11
Scrub shrub	0.33	0.33	0
Herbaceous	3.78	3.93	-0.15
Hay/Pasture	18.68	22.05	-3.37
Cultivated crops	14.17	11.10	3.07
Woody Wetlands	1.09	0.82	0.27
Emergent Wetlands	0.23	0.25	-0.03

Kentucky can be divided into five distinctive physiographic regions that include the Eastern Coal Fields, Bluegrass Region, Mississippian Plateau (Pennyrile), Western Kentucky Coalfields, and the Mississippi Embayment (Jackson Purchase). A wide range of habitat types are found in Kentucky, including numerous wetlands and streams, deciduous and evergreen forests, karst and cave features, and prairie habitat.

Land use in Kentucky varies across the state and includes: agricultural farmland, livestock farmland, forest, streams and wetlands, residential, industrial, mining for natural resources, infrastructure, urban development, and others. Today, much of Kentucky's natural habitat has been disturbed; however, about 1,950,541 acres land has been conserved to be publicly managed by state and federal agencies, many for fish and wildlife benefits (KDFWR 2005). 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 92.5 percent of Kentucky which remains privately owned and plays an important role in the overall landscape of Kentucky providing natural and semi-natural habitats to support wildlife diversity.

A 2007 Forest Inventory and Analysis published by the U.S. Forest Service (Oswalt, et al. 2010) reported that 12.4 million acres of Kentucky's land base (48 percent) is forestland. This was a slight increase over the numbers reported in 2004 which was a six percent decrease since 1988 (Turner, et al. 2004). However these numbers are still greater than those acreages reported in 1949 and 1963. 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 75.2 percent of the total forestland acreage. The stand-size distribution has seen a steady increase in sawtimber-size stands since 1975 with a seven percent increase in acreage since 1988. In spite of the reduction in total forest land acreage between 1988 and 2004, Kentucky saw an increase in growing-stock volume and the percentage of hardwood board-foot volume for tree grades 1 and 2 for the same period (Turner, et al. 2004). These data appear to show that potentially available forest habitat for Indiana bats has slightly declined over the past 20 years in Kentucky, but the habitat has become larger and likely more suitable for use by Indiana bats.

II. STATUS OF THE SPECIES/CRITICAL HABITAT

Current Status

On 15 April 2007, the Service released the *Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision* (USFWS 2007), which contains a summary of the current status of the Indiana bat. In addition, the Service's Bloomington, Indiana Field Office (BFO) recently completed a 5-Year Review of the Indiana bat (USFWS 2009), which summarizes the current status of the species, progress towards recovery, and remaining threats to the bat. Both the draft recovery plan and 5-Year Review are available on the Service's Indiana bat website at http://www.fws.gov/midwest/Endangered/mammals/inba/index.html and are hereby incorporated by reference. The 5-Year Review 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.

Furthermore, since the April 2007 release of the Draft Recovery Plan, the BFO has collated the population data gathered during the 2007 and 2009 biennial winter hibernacula surveys from throughout the Indiana bat's range and preliminarily determined that the Indiana bat's 2009 range-wide population stands at approximately 390,000 bats, which is a 16.6% decrease over the 2007 range-wide population estimate of 468,000 bats (USFWS, unpublished data, 2010). The range-wide, biennial population estimates had been increasing since at least 2001, indicating that the species' long-term decline had been arrested and likely reversed (USFWS, unpublished data, 2010). The observed range-wide decline in 2009 is partly attributable to the recently described White-Nose Syndrome (or "WNS"; see discussion below), especially for the decreased population estimates in the Northeast Recovery Unit. The species' range-wide, regional, state, and hibernacula-specific population trends are being closely monitored by the BFO.

Given the 2009 range-wide Indiana bat population estimate of approximately 390,000, we assume that there are approximately 2,438 to 3,250 maternity colonies throughout the species' entire range [assuming a 50:50 sex ratio (Humphrey et al. 1977) and an average maternity colony size of 60 to 80 adult females (Whitaker and Brack 2002) (Table 2)]. Using the most recent rangewide data, the Service has location records for approximately 269 maternity colonies (USFWS 2007), which, based on the assumptions above, represents 8 to 11% of the assumed number of maternity colonies in existence (Tables 2 and 3).

Table 4. Estimated number of Indiana bat maternity colonies range-wide.

Year	Estimated Rangewide Population	% Change from Previous Period	Estimated Number of Maternity Colonies[4]	Approximate Number of Known Maternity Areas[5]	% of Est. Maternity Colonies that are Known
1960/1970	883,300		5,500	1 (in 1971)	~0.02%
~1980	509,708	-42%	3,200	31	~1.0%-
~1990	373,395	-27%	2,300	70	~3.0%
2001	328,526	-12%	2,100	149	~7.1%
2009	390,000	+19%	2,400	269	~11.2%

[4] Total rounded to the nearest 100. Estimates of the number of maternity colonies rangewide were developed based on the following assumptions: a) the known hibernating population is the source of the entire summer population; b) there is a 50:50 sex ratio (Humphrey et al. 1977); c) average maternity colony size of 80 adult females (Whitaker and Brack 2002); and d) the trend in decline of the total number of maternity colonies follows that of the hibernating population

[5] This is the number of areas where reproductive females and/or juveniles have been captured during the maternity season (USFWS, unpublished data, 2006).

Table 5. States and counties with recorded Indiana bat maternity colonies (current as of 2007).[6][7][8] These colonies are considered likely to be locally extant (within limits of data noted in footnote 5).

State	No. of Recorded Maternity Colonies	Counties with Recorded Maternity Colonies (if multiple colonies, then # is shown)
Arkansas	1	Clay
Illinois	28	Adams (2), Alexander, Bond, Cass, Ford, Henderson, Jackson (3), Jersey, Macoupin, Monroe (4), Pike (2), Pulaski, Randolf, Saline, Schuyler, Scott, St. Clair, Union, Vermilion, and Washington (2)
Indiana	83	Bartholomew (3), Clinton (2), Crawford, Davies (2), Dearborn, Gibson (2), Greene (3), Hendricks (2), Henry, Howard, Huntington, Jackson (3), Jasper, Jay, Jefferson (2), Jennings (2), Johnson (3), Knox, Koskiusko, LaPorte (2), Marion, Martin, Monroe (2), Montgomery (3), Morgan (4), Newton, Parke (2), Perry (2), Pike (2), Posey, Pulaski (2), Putnam (2), Randolph (3), Ripley (2), Rush, Shelby (2), Spencer, St. Joseph, Steuben, Tippecanoe (4), Vermillion, Vigo, Wabash (2), Warren (2), Warrick (2), Wayne, and Wells
Iowa	27	Appanoose (2), Davis, Decatur (2), Des Moines (2), Iowa, Jasper, Keokuk, Lucas (2), Madison (2), Marion (7), Monroe, Ringgold, Van Buren, Wapello, and Washington (2)
Kentucky	32	Ballard, Ballard/Carlisle, Bath (3), Breckinridge, Bullitt (4), Daviess, Edmonson (3), Floyd, Harlan (3), Henderson (2), Hickman (2), Jefferson (3), Logan, McCracken (2), Pulaski, Rowan, Spencer, and Union
Maryland	2	Carroll (2)
Michigan	11	Calhoun, Cass, Eaton, Hillsdale, Jackson, Lenawee (2), Livingston, St. Joseph (2), and Van Buren
Missouri	20	Chariton, Gasconade, Iron, Jefferson, Knox (2), Lewis, Linn, Macon, Madison, Marion, Mercer, Monroe, Nodaway, Pulaski, Scotland, St. Francois, St. Genevieve, Sullivan, and Wayne
New Jersey	7	Morris (5), Somerset, and Sussex
New York	31	Cayuga, Dutchess (5), Essex, Jefferson (9), Onondaga (4), Orange (8), and Oswego (3)
Ohio	11	Ashtabula, Butler, Clermont, Cuyahoga, Greene, Hocking, Lawrence, Paulding, Pickaway, Summit, and Wayne
Pennsylvania	2	Berks and Blair
Tennessee	3	Blount (2) and Monroe
Vermont	7	Addison (6) and Chittenden
Virginia	1	Lee
West Virginia	3	Boone (2) and Tucker
Total	**269**	

[6] Unpublished data obtained in response to a data request sent to Service Field Offices in February 2006.

[7] Most maternity colony records were based upon the capture of reproductively active females and/or juveniles between 15 May and 15 August.

[8] This table includes records of maternity colonies considered to be locally extant (even though records may not have been verified in recent years). Although some additional records exist, we did not include them if subsequent surveys failed to detect their presence (i.e., the colony may have disbanded, relocated, was extirpated, or was present but not found). Records were also not included if suitable habitat no longer exists at a previously occupied site.

Recovery Efforts

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: 1) range-wide population monitoring at the hibernacula with improvements in survey techniques; 2) conservation and management of habitat (hibernacula, swarming, and summer); 3) further research into the requirements of and threats to the species; and 4) 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 2). The proposed 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.

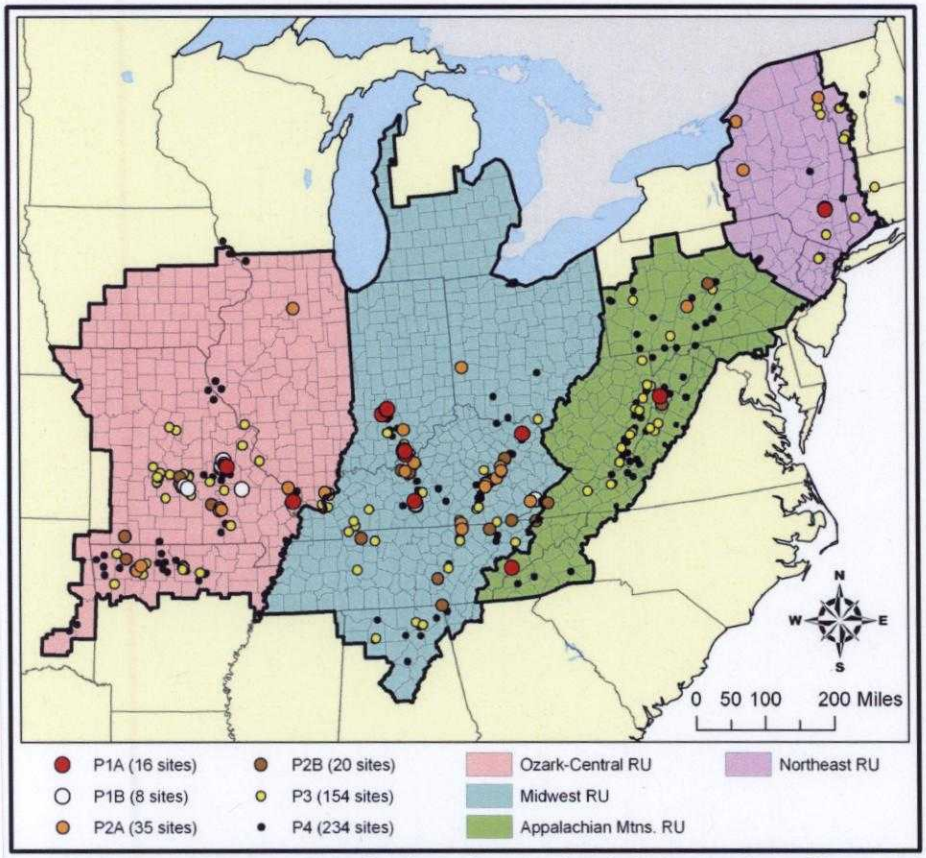

Figure 2. Proposed Recovery Units for the Indiana bat in relation ot locations of known hibernacula (USFWS 2010, unpublished data)

As of the winter of 2008-2009, the proposed action area's 147 hibernacula harbored approximately 212,129 Indiana bats (54.7% of the range-wide population) (USFWS, unpublished data, 2010). Eighty-two percent of the bats that hibernate within the action area are found in the ten P1 sites that include: Magazine Mine (IL), Batwing Cave (IN), Wyandotte Cave (IN), Jug Hole Cave (IN), Twin Domes Cave (IN), Bat Cave (KY), Dixon Cave (KY), Coach Cave (KY), Long Cave (KY), and Line Fork Cave (KY).

New Threats: WNS and Wind Turbines

Recently, a new threat has emerged with serious implications for the wellbeing of North American bats, including the Indiana bat. White-Nose Syndrome (WNS) was first documented in a photograph taken in a New York cave in February 2006. Since that time, at least 160 sites in 11 states (New York, Massachusetts, Vermont, New Hampshire, Connecticut, Virginia, West Virginia, Pennsylvania, New Jersey, Maryland, and Tennessee) and two Canadian provinces (Ontario and Quebec) have been documented with WNS, including approximately 51 known Indiana bat hibernacula. In some affected hibernacula in New York and New England, 90 to 100 percent of the bats occupying those sites have died. Some scientists estimate that WNS has killed more than a million hibernating bats (BCI 2010). The regional population of Indiana bats in the states currently affected by WNS suffered a 30% decline (loss of 20,813 bats) from 2007 to 2009.

WNS has been characterized as a condition primarily affecting hibernating bats. Affected bats usually exhibit a white fungus on their muzzles and often on their wings and ears as well (Blehert et. al. 2009). Some affected bats may display abnormal behavior including flying during the day and in cold weather (i.e., before insects are available for foraging) and roosting towards a cave's entrance where temperatures are much colder and less stable. Many of the affected bats appear to have little-to-no remaining fat reserves, which are necessary for the bats to survive until spring emergence.

Recently, the fungus associated with WNS was identified. It was a previously undescribed species of the genus *Geomyces* and was named *Geomyces destructans*) (Gargas et. al. 2009). The fungus thrives in the cold and humid conditions of bat hibernacula. It is unclear at this point if the fungus is causing the bat deaths directly, or if it is secondary to the cause of death. All of the possible modes of transmission are not currently known, although biologists suspect it is primarily spread by bat-to-bat contact. In addition, people may unknowingly contribute to the spread of WNS by visiting affected caves and subsequently transporting fungal spores to unaffected caves via their clothing and gear. Interestingly, *G. destructans* has been documented growing on hibernating bats in several European countries, but the fungus does not appear to be causing widespread mortality there (Puechmaille et al. 2010).

Currently, WNS has primarily been documented within the Northeast and Appalachian Mountain RUs (Figure 2). However, in the winter of 2009-2010, WNS was also confirmed in three caves in central Tennessee, which falls within the Midwest RU and *G. destructans* was detected on bats in Missouri, which is in the Ozark-Central RU. The Midwest RU covers the states of Indiana, Kentucky, Ohio and portions of Alabama, Georgia, Michigan and Tennessee (Figure 2). The syndrome has been confirmed in the Indiana bat, little brown bat, small-footed bat, northern long-eared bat, southeastern bat, tricolored bat and big brown bat. The *G. destructans* fungus

has also been detected on two additional bat species; gray bats and cave myotis. There are many aspects of WNS that remain unknown including: (A) Are there species' and/or regional differences in susceptibility and mortality rates? (B) How long do symptoms take to manifest themselves? and (C) What are the long-term population effects of WNS? Meanwhile, the Service, States and multiple researchers are continuing to learn more about the disease and options for minimizing its spread and impacts. To date, no WNS-related mortality has been documented in the Midwest or Ozark-Central RUs, but the disease will likely continue to spread throughout these regions within the next several winters and some unknown degree of mortality is likely to occur. For more information see http://www.fws.gov/WhiteNoseSyndrome/.

Lastly, 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. The Service is now working with wind farm operators to avoid and minimize incidental take of bats and assess the magnitude of the threat. For more information see http://www.fws.gov/midwest/News/release.cfm?rid=177.

Rangewide Status

This section is a discussion of the range-wide status of the Indiana bat and presents biological and ecological information relevant to formulating the biological opinion. It includes information on the species' life history, its habitat and distribution, and the effects of past human and natural factors that have led to the current status of the species.

The Indiana bat was officially 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 Endangered Species Act of 1973 extended full protection to the species. The Service has published a recovery plan (USFWS 1983) which outlines recovery actions. Briefly, the objectives of the plan are to: (1) protect hibernacula; (2) maintain, protect, and restore summer maternity habitat; and (3) monitor population trends through winter surveys. Thirteen winter hibernacula (11 caves and two mines) in six states were designated as Critical Habitat for the Indiana bat in 1976 (Federal Register, Volume 41, No. 187). Four of these designated critical habitat sites occur within the proposed action area: Wyandotte Cave (IN), Ray's Cave (IN), Bat Cave (KY), and Coach Cave (KY).

Because the vast majority of Indiana bats form dense aggregations or "clusters" on the ceilings of a relatively small number of hibernacula (i.e., caves and mines) each winter, conducting standardized surveys of the hibernating bats is the most feasible and efficient means of estimating and tracking population and distribution trends across the species' range. Collectively, winter hibernacula survey data provide the Service with the best available representation of the overall population status and relative distribution.

For several reasons, interpretation of the census data must be made with some caution. First, winter survey data has traditionally been subdivided by state due to the nature of the data collection. As described below, each state does not represent a discrete population center. Nevertheless, the range-wide population status of the Indiana bat has been organized by state

thus far. Second, as will be further discussed, available information specific to the "reproductive unit" (i.e., maternity colony) of the Indiana bat is limited. While winter distribution of the Indiana bat is well documented, relatively little is known as to the size, location and extant number of maternity colonies for the Indiana bat. As described previously, it is estimated that the locations of approximately 90 percent of the estimated maternity colonies remain unknown.

Additionally, the relationship between wintering populations and summering populations is not clearly understood. For example, while it is known that individuals of a particular maternity colony come from one to many different hibernacula, the source (hibernacula) of most, if any, of the individuals in a maternity colony is not known. As discussed in the "Spring Emergence/Migration" section, Indiana bats have been documented to travel up to 300 miles from their hibernaculum to their maternity areas (Gardner and Cook 2002). As such, the origin of the bats (hibernacula) that comprise the maternity activity in the action area is unknown.

Rangewide Winter Hibernacula Surveys

The data regarding Indiana bat abundance prior to Federal listing are limited, but the information suggests that they were once far more abundant than they were in the 1960s. Tuttle and colleagues, for example, believe the overall abundance of Indiana bats likely rivaled that of the now extinct passenger pigeon (USFWS 2007). The basis for Tuttle's and others estimates of millions of Indiana bats prior to European settlement is primarily based on historic accounts (e.g., Blatchley 1897, Silliman et al. 1851), extensive staining left on the ceilings of several historic hibernacula (Tuttle 1997, Tuttle 1999), and other paleontological evidence (Munson and Keith 1984, Toomey et al. 2002). For example, an analysis of bone deposits in Bat Cave, KY revealed that an estimated 300,000 Indiana bats died during a single flood event at some point in history (Hall 1962). Although we are never likely to know the true historical abundance of Indiana bats, it seems clear from the evidence above that Indiana bats were much more abundant than observed in 1960.

When the Indiana bat was originally listed as endangered in 1967, there were approximately 883,300 bats (Figure 3) and most of these hibernated in a small number of hibernacula (Clawson 2002).

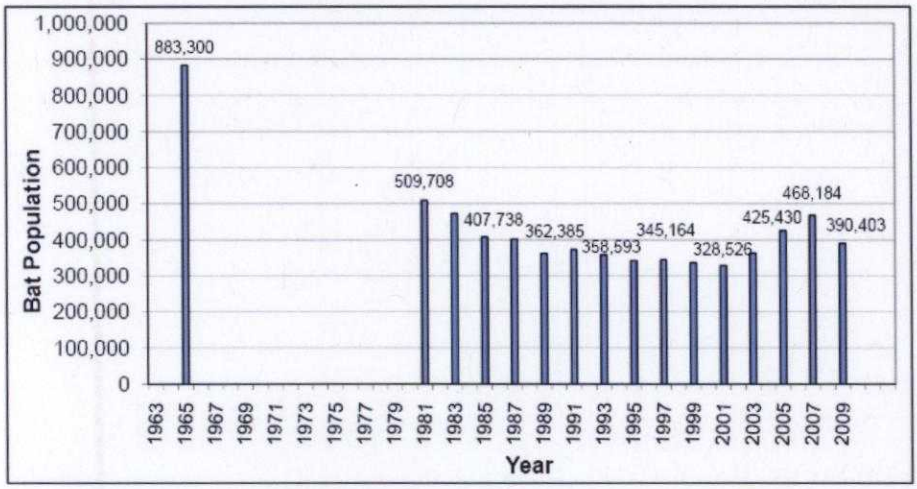

Figure 3. Indiana bat rangewide population estimates (data sources: 1965-1990, Clawson 2002; 2001-2009, USFWS 2010, unpublished data)

Since the species was listed, its population numbers have apparently continued to decline through approximately 2001. Although some winter bat surveys began as early as the late 1950s, systematic surveys were not conducted across the range until the mid 1980s when there were an estimated 678,750 Indiana bats (Clawson 2002). Since being listed, large population declines have been observed, especially at hibernacula in Kentucky and Missouri. Caves in Kentucky suffered dramatic losses because of changes in microclimate due to poor cave gate design in two of the three most important hibernacula (Humphrey 1978), and Indiana bat numbers in Kentucky hibernacula had continued to decline until 2005 when an increase was first observed (USFWS 2007, unpublished data). Despite recovery efforts, Indiana bats in Missouri caves have continuously declined with a loss of more than 80 percent of the previous population size (Clawson 2002). From the 1960s/70s to the most recent population survey in 2009, the rangewide population of the Indiana bat has declined from approximately 883,300 Indiana bats for 1960/1970 to 390,000 in 2009, or approximately 56 percent. The 40-year population trend from 1960 – 2000 of the Indiana bat has shown a steady decline (Figure 3).

The 2005 Indiana bat rangewide population estimate totaled approximately 425,430 bats; a 17% increase over the 2003 estimate of 364,030 bats (USFWS 2010, unpublished data; Figure 3). In 2005, about 60% of the estimated 425,430 Indiana bats were hibernating in nine Priority 1 hibernacula in four states: 4 hibernacula in Indiana, 3 in Missouri, 2 in Kentucky and 1 in Illinois (USFWS 2005, unpublished data). Priority 2 hibernacula are known from the aforementioned states and from Arkansas, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. Priority 3 hibernacula have been reported in 21 states, including all of the aforementioned states (see Figure 2).

Although a notable increase (10.8%) over the previous biennial rangewide population estimate first occurred in 2003, these results may not be statistically or biologically significant, and no determinations can be made with confidence from such a limited survey period. Small fluctuations from year-to-year may be attributed to such factors as weather affecting the success of reproduction for a given year (Humphrey and Cope 1977); and therefore, it is not appropriate to extrapolate long-term trends from changes between individual survey periods. Nonetheless, in 2005 there was almost a 17% increase over the 2003 estimate and another 10% increase between 2005 and 2007. Unfortunately, the rangewide population experienced an apparent 16.6% decline in 2009 (USFWS, unpublished data, 2010). This was the first observed decline in the range-wide population since 2001. The observed decline between 2007 and 2009 was partly a result of WNS-related mortality in the Northeast as mentioned above, but large, as of yet unexplained, population declines also occurred at some key hibernacula in Indiana and Kentucky as well. Nearly half of the 2009 range-wide population hibernated in caves within the bat's namesake state of Indiana (Figure 4).

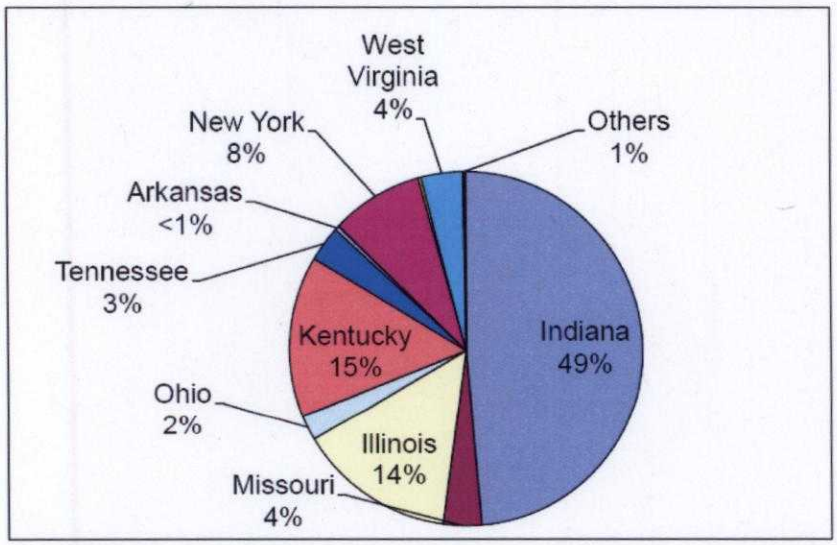

Figure 4. Rangewide distribution of hibernating Indiana bat populations in 2009 (estimated at approximately 390,000 bats) (USFWS 2010, unpublished data)

Some investigators believe that warmer winter temperatures may have resulted in less conducive microhabitat conditions (warmer temperatures) at hibernacula, particularly in the southern part of the species range (Clawson 2002), but this has yet to be rigorously investigated. Other declines have occurred as winter hibernacula have flooded, hibernacula ceilings have collapsed, or cold temperatures kill bats through hypothermia. Exclusion of bats from hibernacula through blocking of entrances, installation of gates that do not allow for bat ingress and egress, disruption of cave air flow, and human disturbance during hibernation have been documented causes of Indiana bat declines. Because many known threats are associated with hibernation, protection of hibernacula still remains a top management and recovery priority. Although some hibernacula have been restored in order to support future wintering populations, Indiana bats have not returned to some of these hibernacula as anticipated while they have quickly recolonized others.

Despite the protection of most major hibernacula, population declines generally have continued until the apparent increases in 2003 - 2007. Continued population declines of Indiana bats, in spite of efforts to protect hibernacula, initially led some scientists to the conclusion that additional information on summer habitat is needed (Rommé et al. 1995), but others contended that the primary cause of continued declines stemmed from suboptimal microclimates within traditional hibernacula and/or high human disturbance levels (Tuttle and Kennedy 2002). In addition to increased focus on these issues, attention has also been directed to pesticide contamination. Insecticides have been known or suspected as the cause of a number of bat die-offs in North America, including endangered gray bats (*Myotis grisescens*) in Missouri (Clark et al. 1978). The insect diet and longevity of bats also exposes them to persistent organochlorine chemicals which may bioaccumulate in bat tissue and cause sub-lethal effects such as impaired reproduction.

Maternity Colonies

To date, most records of reproductively active female and juvenile Indiana bats have occurred in glaciated portions of the upper Midwest including southern Iowa, northern Missouri, most of Illinois, most of Indiana, southern Michigan, and western Ohio (Gardner and Cook, 2002;

USFWS 2010 unpublished data; Table 3). The first maternity colony was found in east-central Indiana in 1971 and most subsequent surveys and studies of Indiana bat maternity habitat have been conducted in the upper Midwest (Cope et al. 1974, Clawson 2002). Unglaciated portions of the Midwest (southern Missouri, parts of southern Illinois, and south-central Indiana), Kentucky, and most of the eastern and southern portions of the species' range appear to have fewer maternity colonies per unit area of forest than does the upper Midwest. Increased summer survey efforts are needed elsewhere in the range, however, before final conclusions may be reached regarding relative abundance across the species' summer range.

In recent years, multiple maternity colonies have been discovered in the Champlain Valley and lower elevations of adjacent hills between Burlington, Vermont, and Ticonderoga, New York (USFWS 2007). In contrast, the first maternity roosts in "the South" were found in very different types of habitat, in areas of extensive mature forest in the southern Appalachian Mountains of North Carolina and Tennessee. In further contrast, these colonies were found roosting in eastern hemlock (*Tsuga canadensis*) and pines (*Pinus* spp.), rather than deciduous trees (Harvey 2002).

Based on published literature and correspondence with Service and state biologists throughout the range of the Indiana bat, maternity activity has been documented at approximately 269 locations throughout the species' range (USFWS 2007, Table 3). The majority of confirmed maternity areas are in the "core" of the range, in the glaciated Midwest in pockets of remaining forested habitat within a predominantly agricultural landscape and in the Northeast (i.e., NY and VT). Because the Indiana bat is philopatric (i.e., loyal to its traditional summering area), there is currently no evidence to suggest that all maternity colonies are located in optimal foraging and roosting habitat. A possibility that may have contributed to the species' decline is that many existing maternity colonies are senescent (i.e., deaths outnumber births) or are population sinks. This could be caused by pups being produced but not surviving their first hibernation period; or maternity areas are no longer providing a sufficient supply of suitable prey, resulting in an increase in the age of first reproduction and increasing fecundity schedules. Proof of at least several years of successful reproduction and recruitment would be needed to verify long-term survival of the Indiana bat in these highly altered and fragmented landscapes. Although data at a few maternity sites indicate that reproduction is occurring (i.e., exit counts nearly double a month after birth), long-term monitoring of maternity sites is limited. Long-term monitoring has been conducted at a maternity colony located near the Indianapolis Airport (Whitaker and Sparks 2003, Whitaker et al. 2004). This colony continues to persist and shows evidence of reproduction, although additional monitoring is needed to make a determination regarding whether the colony is stable, increasing, or decreasing at this site.

Monitoring data, including extensive exit counts to estimate maternity colony population size and structure over more than one-year, is available for only a few of the approximately 269 maternity colonies discovered (Humphrey et al. 1977; Garner and Gardner 1992; Callahan 1993; Gardner et al. 1991b; Kurta et al. 1993; Whitaker and Sparks 2003, Whitaker et al. 2004). Additionally, because the vast majority of the Indiana bat maternity colonies have not been discovered, let alone studied, what little demographic data that is available, represent a fraction of the range-wide maternity activity.

Because so little is known regarding the population size and structure of maternity colonies, the Service used the same assumption as Whitaker and Brack (2002) to determine the average maternity colony size to give an approximation of the number of potential maternity colonies across the range of the Indiana bat. The Service recognizes that maternity colonies are not static in size, and the numbers of individuals that comprise a maternity colony likely vary widely as a colony adjusts to current conditions, including the availability and quality of roosting and foraging habitat, and variable climatic conditions. Therefore, these figures should not be used to make extrapolations regarding the densities or distribution of maternity colonies present within portions of the species range (Racey and Entwistle 2003); however, these figures do serve to provide a rough estimation regarding the number of maternity colonies that might be present across the landscape.

Recognizing the inherent deficiency in such an assumption, these calculations illustrate that the vast majority of maternity colonies for the Indiana bat have not been documented. The location of most maternity colonies may always remain unknown because of the difficulty in detecting maternity activity for the Indiana bat. Some unknown proportion of these colonies may be at risk when land use practices and changes, such as timber harvesting and development, are carried out. Therefore, another likely cause for the decline of this species is that some maternity colonies are being reduced in numbers, and in some cases extirpated, prior to their discovery.

Previous Incidental Take Authorizations

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

(a) The Forest Service for activities implemented under various Land and Resource Management Plans on National Forests in the eastern United States;
(b) The Federal Highway Administration for various transportation projects;
(c) 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;
(d) The Department of Defense for operations at several different military installations;
(e) The National Park Service for vegetation management and prescribed burn activities; and
(f) The Fish and Wildlife Service for the management of national wildlife refuges.

Additionally, an incidental take permit has been issued under section 10 of the ESA to an Interagency Taskforce for expansion and related development at the Indianapolis Airport in conjunction with the implementation of a Habitat Conservation Plan (i.e., Six Points Road Interchange HCP). Additional HCPs are being developed for a privately owned natural gas pipeline/storage field system, a State-operated forestry program, and several private wind power developments.

A summary of the formal consultations completed since 1998 is discussed below and provided in Appendix C. 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 proposed action. This is due to several reasons, including:

(a) 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;
(b) The authorized take in many biological opinions has been superseded by new biological opinions; and
(c) 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 proposed 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 project-related conservation measures 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 biological opinion), 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 C shows that biological opinions have exempted take of Indiana bats on about 2,957,899 acres of potentially occupied habitat since 2000.

Of this exempted take, approximately 218,960 acres have been superseded by new biological opinions, which reduce the total take acreage to 2,738,939 acres range-wide. It is important to subtract out the acreage of incidental take exempted in those biological opinions which are no longer in affect 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 National Forest 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 2,738,939 acres of exempted take currently active, approximately 2,649,741 acres (96.7 percent) are for the U.S. Forest Service, primarily for National Forests' land and resource management plans (LRMP) 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.

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 National Forests 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 National Forests and one Forest Service Research Station within the range of the Indiana bat have recently 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 the loss of any maternity colonies on a National Forest (NF).

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 National Forests [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 DBNF and other National Forests are ongoing but are not systematic. The National Forests 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 National Forests.

Incidental take exempted on National Forests 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 National Forest 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).

Additionally, this exempted incidental take does not account for the expected habitat gains (beneficial effects) associated with many of these National Forest projects. Prescribed burning on National Forests 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 National Forest plan calls for retaining all shagbark hickories with a diameter-at-breast height (d.b.h.) 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 National Forest provides annual reports of the actual level of take that has been implemented. Although reported levels have not been compiled for all the Forests, the actual incidental take used has been less than the level exempted in the biological opinions for many Forests. 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 National Forest Land and Resource Management Plans, 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 young; (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 acreage of exempted take within the last 10 years for non-U.S. Forest Service projects (including other Federal agencies and one HCP) is estimated at 89,198 acres or approximately 0.024 percent of the range. It should be noted that the largest non-USFS incidental take authorization included in this analysis is associated with the 2008 Indiana bat Conservation Memoranda of Agreement biological opinion, which authorized up to 40,000 acres of habitat over five years. This biological opinion supersedes that 2008 opinion and significantly reduces the amount of authorized incidental take. Additionally, of the 24,000 acres authorized by that biological opinion for 2008 – 2010, only ~1,300 acres were actually used.

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 (USFWS 1999) exempted the incidental 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) exists (Hawkins, et. al 2008). We have no data that tracks the take of maternity colonies for the GSMNP 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, the full extent of the anticipated impacts may not yet have occurred. Nonetheless, these monitoring results, and the lack of data to suggest otherwise, indicate that the conservation measures to avoid and minimize the impacts of Federal projects appear to be effective.

In summary, we believe the take exempted to date via section 7 consultation has resulted in short-term effects to Indiana bat habitat and, in limited circumstances, Indiana bat maternity colonies. 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 is less than anticipated. 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 overall conservation status (i.e., environmental baseline) of the Indiana bat.

Indiana Bat Description and Distribution

The Indiana bat is a medium-sized bat with a head and body length that ranges from 41 to 49 mm (Thompson 1982). There are no recognized subspecies. The species range includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida. The Indiana bat is migratory, and the above described range includes both winter and summer habitat. The winter range is associated with regions of well-developed limestone caverns. The largest populations of this species hibernate in Indiana, Kentucky, Illinois, and New York (Figure 3). Smaller winter populations have been reported from Alabama, Arkansas, Georgia, Maryland, Mississippi, Missouri, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia. Half (50%) of the entire estimated 2009 population of Indiana bats hibernated in only five hibernacula in Illinois, Indiana, and Kentucky and more the 75% of the rangewide population hibernated in only 12 hibernacula (USFWS 2010, unpublished data).

Life History

The average life span of the Indiana bat is 5 to 10 years, but banded individuals have lived up to 14 and 15 years (Thomson 1982). Female survivorship in an Indiana population was 76% for ages 1 to 6 years and 66% for ages 6 to 10 years. Male survivorship was 70% for ages 1 to 6 years and 36% for ages 6 to 10 years (Humphrey and Cope 1977).

Summering Indiana bats (males and females) roost in trees in riparian, bottomland, and upland forests. Roost trees generally have exfoliating bark which allows the bat to roost between the bark and bole of the tree. Cavities and crevices in trees also may be used for roosting. A variety of tree species are used for roosts including (but not limited to) silver maple (*Acer saccharinum*), sugar maple (*Acer saccharum*), shagbark hickory (*Carya ovata*), shellbark hickory (*Carya laciniosa*), bitternut hickory (*Carya cordiformis*), green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), eastern cottonwood (*Populus deltoides*), northern red oak (*Quercus rubra*), post oak (*Quercus stellata*) , white oak (*Quercus alba*), shingle oak (*Quercus imbricaria*), slippery elm (*Ulmus rubra*), American elm (*Ulmus americana*), and sassafras (*Sassafras albidum*)(Rommé et al. 1995). At one site in southern Indiana, black locust (*Robinia psuedoacacia*) was used extensively by roosting bats (Pruitt 1995). Structure is probably more important than the species in determining if a tree is a suitable roost site; and tree species which develop loose, exfoliating bark as they age and die are likely to provide roost sites.

Male bats disperse throughout the range and roost individually or in small groups. In contrast, reproductive females form larger groups, referred to as maternity colonies in which they raise their offspring. Females arrive in summer habitat as early as April 1. Temporary roosts are often used during spring until a maternity roost with large numbers of adult females is established. Indiana bats arrived at maternity roosts in April and early May in Indiana, with

substantial numbers in mid-May. Most documented maternity colonies have 50 to 100 adult bats (USFWS 2007). Fecundity is low; and female Indiana bats produce only one young per year in late June to early July. Young bats can fly between mid-July and early August, at about 4 weeks of age. Mortality between birth and weaning was found to be about 8% (Humphrey et al. 1977). Many males stay near hibernacula (i.e., caves and mines) and roost individually or in small groups (Whitaker and Brack 2002). The later part of the summer is spent accumulating fat reserves for fall migration (USFWS 2007).

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. Females typically arrive later and by September numbers of males and females are almost equal. Swarming is a critical part of the life cycle when Indiana bats converge at hibernacula, mate, and forage until sufficient fat reserves have been deposited to sustain them through the winter (Cope et al. 1977, USFWS 1983). Swarming behavior typically involves large numbers of bats flying in and out of cave entrances throughout the night, while most of the bats continue to roost in trees during the day. Body weight may increase by 2 grams within a short time, mostly in the form of fat. Swarming continues for several weeks and copulation occurs on cave ceilings near the cave entrance during the latter part of the period. (USFWS 2007). The time of highest swarming activity in Indiana and Kentucky has been documented as early September (Cope et al. 1977). By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females. Research is needed to determine how far bats will forage in the fall. Most bats tracked have stayed within 2 to 3 miles of the hibernacula, but some have been found up to 4.2 miles away (Rommé et al. 2002). Studies suggest that the majority of foraging habitat in spring and autumn is within 2 mi of the hibernacula, but extends to 5 miles or more. Therefore, it is not only important to protect the caves that the bats hibernate in, but also to maintain and protect the quality and quantity of roosting and foraging habitat within 5 miles of each Indiana bat hibernaculum. Additional studies of fall swarming behavior are warranted to gain a better understanding of the bats' behavior and habitat needs during this part of its annual life cycle (Rommé et al. 2002).

During swarming, males are active over a longer period of time at cave entrances than females, probably to mate with females as they arrive. Females may mate their first autumn, whereas males may not mature until the second year (USFWS 2007). 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 cave ceilings in densities of approximately 300-484 bats per square foot, from approximately October through April. Hibernation facilitates survival during winter when prey (i.e., insects) is unavailable. The season of hibernation may vary by latitude and annual weather conditions. Clusters may protect central individuals from temperature change and reduce sensitivity to disturbance. Like other cave bats, the Indiana bat naturally arouses during hibernation (Sealander and Heidt 1990). Arousals are more frequent and longer at the beginning and end of the hibernation period (Sealander and Heidt 1990). Limited mating occurs throughout the winter and in early April as bats emerge (USFWS 2007).

After hibernation ends in late March or early April, most Indiana bats emerge, and forage for a few days or weeks near their hibernaculum before migrating to their traditional summer roosting

areas. Female Indiana bats emerge first from hibernation in late March or early April, followed by the males. The timing of annual emergence may vary across their range depending on latitude and annual weather conditions. 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). The period after hibernation but prior to spring migration is typically referred to as "staging". 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.

Most bats migrate to the north for the summer, although other directions have been documented (USFWS 2007, Gardner and Cook 2002). A stronger homing tendency has been observed along a north-south axis, than the east-west direction in release studies. Females can migrate hundreds of miles north of the hibernacula. In spring staging, males have been found almost 10 miles from their hibernacula (Hobson and Holland 1995). Less is known about the male migration pattern, but many males summer near the hibernacula (Whitaker and Brack 2002, USFWS 2007).

Food Habits

Indiana bats feed exclusively on flying aquatic and terrestrial insects. Diet varies seasonally and variations exist among different ages, sexes, and reproductive status (USFWS 2007). It is probable that Indiana bats use a combination of both selective and opportunistic feeding to their advantage (Brack and LaVal 1985). Reproductively active females and juveniles show greater dietary diversity perhaps due to higher energy demands. Studies in some areas have found that reproductively active females eat more aquatic insects than do juveniles or adult males (USFWS 2007), but this may be the result of habitat differences (Brack and LaVal 1985).

Lepidoptera (moths), Coleoptera (beetles), and Diptera (midges and flies) consititute the bulk of the diet (Brack and LaVal 1985). Moths (Lepidoptera) have been identified as major prey items that may be preferentially selected (Brack and LaVal 1985), but beetles (Coleoptera) and flies (Diptera) were also found significant (Brack and Tyrell 1990). Diptera taken are especially midges and other species that congregate over water, but are seldom mosquitoes. Other prey include wasps and flying ants (Hymenoptera), caddisflies (Trichoptera), brown leafhoppers and treehoppers (Homoptera), stoneflies (Plecoptera), and lacewings (Neuroptera) (Brack and LaVal 1985, USFWS 2007). Male Indiana bats summering in or near a hibernation cave eat primarily moths and beetles but feed on other terrestrial insects in lower percentages (USFWS 2007).

Habitat

Winter Hibernacula Habitat

Indiana bats roost in caves or mines with configurations that provide a suitable temperature and humidity microclimate (Brack et al. 2003, USFWS 2007). In many caves, suitable temperatures, and therefore roosts, are located near the cave entrance, but roosts may be deeper where cold air flows and is trapped. When bats arrive at hibernacula in October and November, they need a temperature of 50° F (10° C) or below (USFWS 2007). Mid-winter temperatures range from 39 to 46° F (4 to 8° C) (USFWS 1983). Only a small percentage of caves available meet these temperature requirements (Brack et al. 2003, USFWS 2007). Stable low temperature allows bats to maintain low metabolic rates and conserve fat reserves to survive the winter (USFWS 2007).

Relative humidity of roosts usually ranges from 74% to just below saturation, although readings as low as 54% have been recorded. This may be an important factor for successful hibernation (USFWS 2007). Hibernacula often contain large populations of several species of bats. Other bat species found in Indiana hibernacula include little brown bats (*Myotis lucifugus*), eastern pipistrelles (*Pipistrellus subflavus*), northern long-eared bats (*Myotis septentrionalis*), gray bats (*Myotis grisescens*), big brown bats (*Eptesicus fuscus*), and silver-haired bats (*Lasionycteris noctivagans*) (Brack et al.2003).

Summer Roosting Habitat, Female

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 bear their young. (Kurta et al. 2002, Garner and Gardner 1992, USFWS 2007). Traditional summer sites that maintain a variety of suitable roosts are essential to the reproductive success of local populations. 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.

Female Indiana bats generally migrate northward from the hibernacula to summer roosting areas. Indiana bat maternity colonies typically occupy multiple roosts in riparian, bottomland, and upland forests. Roost trees generally have exfoliating bark which allows the bat to roost between the bark and bole of the tree and have a southeast or south-southwest solar exposure and an open canopy. Cavities and crevices in trees also may be used for roosting. Roost tree structure is probably more important than the tree species in determining whether a tree is a suitable roost site; and tree species which develop loose, exfoliating bark as they age and die are likely to provide roost sites. Roost trees are often located on forest edges or openings with open canopy and open understory (USFWS 2007). Maternity colonies have often been found within forests that are streamside ecosystems or are otherwise within 0.6 mi (1 km) of permanent streams. Most have been found in forest types similar to oak-hickory and elm-ash-cottonwood communities. While these characteristics are typical, research is showing adaptability in habitats used. Important summer roosting and foraging habitat for the Indiana bat is often in floodplain or riparian forests but may also be in more upland areas. A telemetry study in Illinois found most maternity roosts within 1640 ft (500 m) of a perennial or intermittent stream (Hofmann 1996). Bats in Illinois selected roosts near intermittent streams and far from paved roads (Garner and Gardener 1992). 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, 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. Instances have been documented of bats using forests altered by grazing, swine feedlots, row-crops, hay fields, residences, clear-cut harvests, and shelterwood cuts (Garner and Gardner 1992, USFWS 1999). Several roosts have been located near lightly traveled, low maintenance roads, as well as near I-70 at the Indianapolis Airport (USFWS 2002). Although, Indiana bats may be more adaptable than previously thought, it still is not known how a maternity colony's stability and reproductive success responds to increasing levels of habitat alteration and fragmentation.

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. Good roost trees are species whose bark springs away from the tree on drying after dead, senescent, or injured; and living species of hickories (*Carya* spp.) and large white oaks (*Quercus alba*) with shaggy bark. Cottonwoods are probably one of the best tree species. Many maternity colonies have been associated with oak-hickory and elm-ash-cottonwood forest types. Tree cavities, hollow portions of tree boles or limbs, and crevice and splits from broken tops have been used as roosts on a very limited basis, usually by individual bats. Roost longevity is variable due to many factors such as the bark sloughing off or the tree falling down. Some roosts may only be habitable for 1-2 years, but species with good bark retention such as slippery elm (*Ulmus rubra*), cottonwood (*Populus deltoides*), Green ash (*Fraxinus pennsylvanica*), oaks (*Quercus* spp.), and hickories (*Carya* spp.) may provide habitat 4-8 years (USFWS 1999). Trees in excess of 15.7 in (40 cm) diameter breast height (d.b.h) are considered optimal for maternity colonies, but trees in excess of 8.6 in (22 cm) d.b.h are used as alternate roosts (USFWS 2002). Females have been documented using roost trees as small as 5.5 inches (Kurta 2005).

Indiana bat roosts are ephemeral and frequently associated with dead or dying trees. Gardner et al. (1991b) evaluated 39 roost trees and found that 31% were no longer suitable the following summer, and 33% of those remaining were unavailable by the second summer. A variety of suitable roosts are needed within a colony's traditional summer range for the colony to continue to exist. Indiana bat maternity sites generally consist of one or more primary maternity roost trees which are used repeatedly by large numbers of bats, and varying numbers of alternate roosts, which may be used less frequently and by smaller numbers of bats. Primary roosts are often located in openings or at the edge of forest stands, while alternate roosts can be in either openings or the interior of the forest stand. Primary roosts are usually surrounded by open canopy and are warmed by solar radiation. Alternate roosts may be used when temperatures are above normal or during precipitation. Bats move among roosts within a season and when a particular roost becomes unavailable from one year to the next. It is not known how many alternate roosts must be available to assure retention of a colony within a particular area, but large, nearby forest tracts would improve the potential for an area to provide adequate roosting habitat (Callahan 1993, Callahan et al. 1997). In addition to having exfoliating bark, roost trees must be of sufficient diameter. Trees in excess of 16 inches d.b.h. are considered optimal for maternity colony roost sites, but trees in excess of 9 inches d.b.h. are often used as alternate maternity roosts. Male Indiana bats have been observed roosting in trees as small as 2.5 inches d.b.h (Gumbert et al. 2002).

Exposure of trees to sunlight and location relative to other trees are important to suitability. Cool temperatures can delay development of fetal and juvenile young and selection of maternity roost sites may be critical to reproductive success. Dead trees with southeast and south-southwest exposures allow warming solar radiation. Some living trees may provide a thermal advantage during cold periods (USFWS 2007). Maternity colonies use multiple roosts in both dead and living trees that are grouped. Extent and configuration of a use area is probably determined by availability of suitable roost sites. Distances between roosts can be a few meters to a few kilometers. Maternity colony movements among multiple roosts seem to depend on climatic

changes, particularly solar radiation (Humphrey et al. 1977). Kurta et al. (1993) suggests movement between roosts may be the bats' way of dealing with a roost site as ephemeral as loose bark. Presumably, the bat that is aware of alternate roost sites is more likely to survive the sudden, unpredictable, destruction of its present roost than the bat which has never identified such an alternate.

Primary roosts are often located in openings or at the edge of forest stands, while alternate roosts can be in either openings or the interior of the forest stand. Primary roosts are usually surrounded by open canopy and are warmed by solar radiation. Alternate roosts may be used when temperatures are above normal or during precipitation. Shagbark hickories (*Carya ovata*) are good alternate roosts because they are cooler during periods of high heat and tight bark shields the bats from rain (USFWS 2007). Weather has been found to have profound influence on bat behavior and habitat use (Humphrey et al. 1977).

Humphrey et al. (1977) observed that each night after the sunset peak of foraging activity the bats left the foraging areas without returning to the day roosts, which indicated the use of "night" roosts. Kiser et al. (2002) found three concrete bridges on Camp Atterbury, 25 mi (40 km) south of Indianapolis, Indiana, used by Indiana bats as night roosts and to a limited extent as day roosts. Bat species using the bridges included the big brown bat (*Eptesicus fuscus*), northern myotis (*Myotis septentrionalis*), little brown myotis (*Myotis lucifugus*), Indiana bat, and eastern pipistrelle (*Pipistrellus subflavus*). The Indiana bat was the most common species, representing 51% of all bats observed, whereas the big brown bat was the second most abundant at 38%. Clusters of Indiana bats were observed night roosting under the bridges that were lactating, post-lactating, and newly volant juveniles. Bridges used were concrete-girder (multi-beam) bridges with deep, narrow expansion joints. The bridges ranged from 46 to 223 ft in length and 26 to 39 ft in width. Average daily traffic ranged from less than 10 vehicles per day to almost 5,000 vehicles per day. All used bridges were located over streams bordered by forested, riparian corridors that connected larger tracts of forest. Riparian forest did not overhang the bridges allowing solar radiation to warm the bridges; however, forest was within 9 to 16.5 ft of each bridge. Bat clusters under bridges were located over land, near the ends of the bridges. Mean ambient temperatures at night were consistently higher and less variable under bridges than external ambient temperatures. The bridges apparently act as thermal sinks. The warmer, more stable environment presumably decreases the energetic cost of maintaining high body temperature, thus promoting fetal development, milk production, and juvenile growth. Three individuals were radio-tracked to their day roosts within 0.6 to 1.2 miles from their night roost (Kiser et al. 2002).

Summer Roosting Habitat, Male

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). Males roost singly or in small groups in two to five roost trees similar to those used by females. Males may occasionally roost in caves. Suitable roost trees typically have a large diameter, exfoliating bark, and prolonged solar exposure with no apparent importance in regard to the tree species or whether it is upland or bottomland (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, and in one instance a roost tree only 2.5 inches

(6.4 cm) in diameter was used (Gumbert et al. 2002). Male bats have also been observed using trees as small as 3.1 in (8 cm) d.b.h. (USFWS 2007). Males have shown summer site fidelity and have been recaptured in foraging areas from prior years (USFWS 2007). At Camp Atterbury in Indiana, male bats were observed using the same bridges as females for night roosts, but they roosted singly (Kiser et al. 2002).

Autumn Swarming/Spring Staging Habitat

Indiana bats use roosts in spring and fall that are similar to those used in summer (USFWS 2007). During fall, when bats swarm and mate at their hibernacula, male bats roost in trees nearby during the day and fly to the cave during the night. Studies have found males roosting in dead trees on upper slopes and ridgetops within a few miles of the hibernacula (USFWS 2007). In Jackson County, Kentucky, research showed fall roost trees tend to be located in canopy gaps created by disturbance (logging, windthrow, prescribed burning) and along edges (Gumbert et al. 2002). Fall roost trees are often exposed to sunshine (USFWS 2007). Within-year fidelity to fall roosts has been observed, where an individual bat uses an individual roost for an average of 2 to 3 days before moving to a new tree (Gumbert et al. 2002). Bats have been observed moving among multiple roosts in an area using particular roosts alternatively (Gumbert et al. 2002).

In the spring, upon emergence, females and some males disperse from the hibernacula. Migration within the core of the species' range is generally northward to form colonies throughout Indiana, southern Michigan, and adjoining Ohio and Illinois. Male Indiana bats remain at or near the hibernacula, although some fan out in a broad band or zone around the hibernacula (Whitaker and Brack 2002).

Spring and autumn habitat use is variable due to proximity and quantity of roosts, weather conditions, and prey availability (Rommé et al. 2002). Several studies support the idea that during the autumn and spring, bats primarily use habitat within 5 miles (8 km) of the hibernacula (Rommé et al. 2002). However, more studies of autumn and spring habitat use are recommended due to low sample sizes and difficulties with telemetry research techniques (USFWS 2007).

Foraging Habitat

Indiana bats forage between dusk and dawn and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects. They typically forage in and around tree canopy and in openings of floodplain, riparian, and upland forests (USFWS 2007). Optimum canopy closures are 50-70% with relatively open understory (<40% of trees are 2-4.7 in (5-12 cm) d.b.h.) (USFS 2000). Woody vegetation with a width of at least 100 ft (30 m) on both sides of a stream has been characterized as excellent foraging habitat. Streams, associated with floodplain forests and impounded water bodies, are preferred foraging habitats for pregnant and lactating Indiana bats, some of which may fly up to 1 ½ mi from upland roosts (Garner and Gardner 1992, USFWS 2002). Brack and Tyrell (1990) found that in early summer, foraging was restricted to riparian habitats. Foraging also occurs over clearings with successional vegetation, along cropland borders, fencerows, and over farm ponds. Bats have been observed crossing Interstate 70 in Indiana to reach foraging habitat (USFWS 2002). Bats have been documented routinely flying at least 1.25 mi (2 km) from the roost to forage and some were tracked up to 3 mi (5 km) from the roost (USFWS 2002). Foraging bats usually fly between 6 – 100 feet above ground level (USFWS 2007). In Illinois, Gardner et al. (1991a) found that forested stream corridors, and

impounded bodies of water, were preferred foraging habitats for pregnant and lactating Indiana bats, which typically flew up to 1.5 miles (2.4 km) from upland roosts to forage. However the same study reported the maximum distance that any female bat flew (regardless of reproductive status) from her daytime roost to her capture site was 2.5 miles (4.2 km). Females typically utilize larger foraging ranges than males (Garner and Gardner 1992).

III. ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the Act, when considering the "effects of the action" on federally listed species, the Service is required to take into consideration the environmental baseline. The environmental baseline includes past and ongoing natural factors and the past and present impacts of all Federal, State, or private actions and other activities in the action area (50 CFR 402.02), including Federal actions in the area that have already undergone section 7 consultation, and the impacts of State or private actions that are contemporaneous with the consultation in process. As such, the environmental baseline is "an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including critical habitat), and ecosystem, within the action area (Service and NMFS 1998, page 4-22)." The environmental baseline is, therefore, a "snapshot" of the species' health at a given point in time, but it does not include the effects of the proposed action. The environmental baseline for this biological opinion considers these "past and ongoing human and natural factors", which includes (a) all projects approved prior to the initiation of formal consultation with the Service, (b) any human and natural factors for which the Service has information that pertains to this consultation, and (c) any other Federal, State, or private actions for which the Service has information that pertains to this consultation.

Previous biological opinions and incidental take statements were discussed in a previous section. Thirty-one of these biological opinions include at least a portion of the action area for this biological opinion. Additionally, the Service completes numerous technical assistance requests and informal consultations on the Indiana bat each year. These formal and informal consultations are discussed in detail in the "Factors affecting the species' environment within the action area" section below.

Status of the species within the action area

According to the known and suspected range of the Indiana bat (USFWS 1983), the Indiana bat ranges over an area of about 580,550 square miles in the eastern one-half of the United States. The action area's surface land area is approximately 62,254 square miles, which represents approximately 11 percent of the total range of the species. However, the occupied range of the species within both the known range and the action area is unknown but is likely to be considerably smaller than the known range and action area, respectively, due to the presence of unsuitable habitats within both of those areas and the lack of a uniform distribution for the species. 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 in the landscape because the caves and other underground features the species relies on for winter habitat 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 147 known hibernacula. Ten 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) in the draft, revised Indiana bat recovery plan (USFWS 2007) and three of these are designated as critical habitat (USFWS 2007). There are also 27 Priority 2 hibernacula (harboring winter populations less than 10,000 but at least 1,000 individuals), 55 Priority 3 hibernacula (harboring winter populations less than 1,000 but at least 50 individuals), and 55 Priority 4 hibernacula (harboring winter populations less than 50 individuals).

Three of the ten Priority 1 hibernacula occur within the Mammoth Cave System, located in the Pennyrile region of the state. This includes Coach Cave, which is a designated critical habitat, Dixon Cave and Long Cave. Cave researchers have suggested that the Mammoth Cave System historically may have provided winter roosts for millions of Indiana bats (Tuttle 1997; Toomey et al. 2002). Two other Priority 1 hibernacula are found in Kentucky's Eastern Coalfields with Bat Cave (designated critical habitat) in the northeast portion of Kentucky and Line Fork Cave in the southeast. Four of the ten Priority 1 hibernacula are found in southern Indiana and include Wyandotte Cave (designated critical habitat), Batwing Cave, Jughole Cave and Twin Domes Cave. Magazine Mine in Illinois is the remaining Priority 1 hibernaculum within the action area. These ten site sites represent 173,968 Indiana bats or nearly 45% of the total 2009 rangewide estimated population and 82% of the Indiana bats known to hibernate within the action area (Service, unpublished data).

Many of these hibernacula occur within areas of existing conservation ownerships, both private and public. Of particular note are the Daniel Boone and Shawnee National Forests 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.

Indiana bat summer habitat is typically ephemeral and is affected by factors such as land use, forest age structure, and other factors that deal with the quality, location, and availability of potential summer habitat. Based on the similarities between Kentucky and the action area that were previously discussed in the "Action area" section of this opinion, the Service expects the following discussion of forestland in Kentucky is representative of the forest trends across the action area.

A 2007 Forest Inventory and Analysis published by the U.S. Forest Service (Oswalt, et al. 2010) reported that 12.4 million acres of Kentucky's land base (48 percent) is forestland. This was a slight increase over the numbers reported in 2004 which was a six percent decrease since 1988 (Turner, et al. 2004). However these numbers are still greater than those acreages reported in 1949 and 1963. 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 75.2 percent of the total forestland acreage. The stand-size distribution has seen a steady increase in sawtimber-size stands since 1975 with a seven percent increase in acreage since 1988. In spite of the reduction in total

forestland acreage between 1988 and 2004, Kentucky saw an increase in growing-stock volume and the percentage of hardwood board-foot volume for tree grades 1 and 2 for the same period.

These data appear to show that the acreage of potentially available forest habitat for Indiana bats has slightly declined over the past 20 years in Kentucky, but the habitat has become larger and likely more suitable for use by Indiana bats. The number of acres in seedling and poletimber-size stands decreased while acres in sawtimber-sized stands increased. Sawtimber has a minimum diameter at breast height (d.b.h.) of 9 inches, and the greatest growth has been seen in the volume of trees with a d.b.h. 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 (Hayes 2003, 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).

Summer records for the species occur across the action area, and 61 maternity colonies have been documented along with a number of locations for solitary males and non-reproductive females. This number is slightly higher than what is reflected in Table 3 of the "Status of the species" section as several new colonies have been discovered in recent years. 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 National Forest, Shawnee Nation Forest, Pine Mountain, the Eastern Coalfields, and along the lower Ohio River floodplains. An assessment of available forested land cover surrounding 61 known maternity records (USFWS 2010, unpublished data) yielded varied results with a steady gradient ranging from 8.8 to 94.6 percent forest within a 2.5 mile (roost trees) or 5.0 mile (mist-net sites) radius of the record (see Figure 5 below). Percent forest cover was determined by evaluating the 2001 National Land Cover Dataset (Harp et al. 2006) for the 2.5- or 5-mile buffer (as appropriate) around each determined maternity area. Forest cover includes deciduous forest, evergreen/coniferous forest, mixed forest, and forested wetlands.

Figure 5. Assessment of available forest habitat surrounding 61 known maternity colonies. (USFWS 2010, unpublished data)

In general, the habitat availability at known maternity sites appears to reflect the overall distribution of forest cover for the state. The figure below (USFS 2010) shows the percent of land in forest, by county, for Kentucky as of 2004. 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.

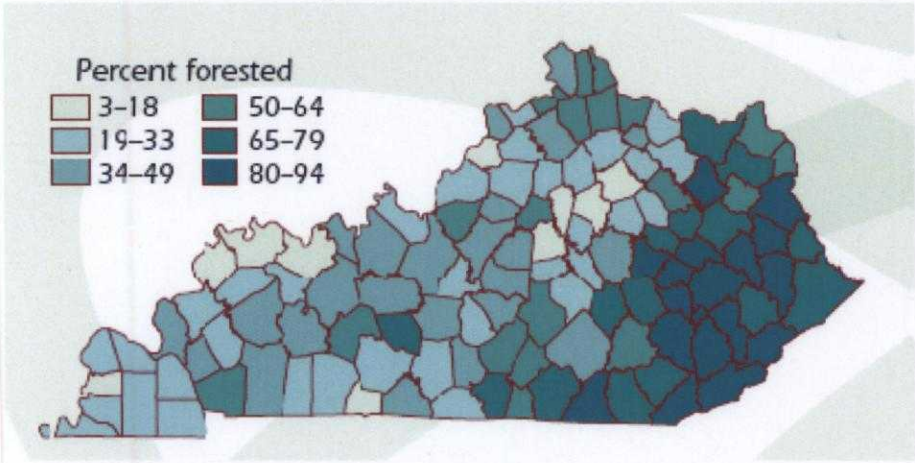

Figure 6. Percent of land in forest by county in Kentucky (Oswalt et al. 2010).

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. Additionally, this biological opinion is based on analysis at a programmatic level rather than a specific project level. However, we are able to determine that there are a number of current and long-term land use and demographic trends could affect the Indiana bat within the action area. As a result of these trends, an 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 the Indiana bat. The extent to which this effect will be offset by new forest regeneration is unknown, but analysis of forest cover loss in the eastern United States found a net decline in forest cover between 1973 and 2000, with declines occurring during all time intervals examined (Drummond and Loveland 2010). In addition, natural factors such as, but not limited to, loss and/or lack of suitable maternity roost trees, reduction in the prey base, or loss and/or reduction in foraging acreage due to invasive species could negatively affect the Indiana bat. 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. 2010).

White-nose syndrome (WNS) is a new, significant threat and a key factor relative to the recovery potential of endangered bat species. WNS has resulted in significant declines of bat populations (including the Indiana bat) in the northeastern U.S. and may cause similar declines in bat populations in other parts of the country, including the action area. Accurate estimates of the number of Indiana bats that have died due to WNS are not available, but New York Indiana bat populations alone have declined by approximately 61% due to WNS since 2006 (Armstrong 2010). The largest populations of Indiana bats (in Indiana, Kentucky, and Illinois) are expected to be affected by WNS within the next year or two.

Within the action area, only one known Indiana bat hibernacula, a priority 3 site, has been documented to have the *G. destructans* fungus present on bats within the cave. This is East Fork Saltpeter cave in Fentress County, TN where it was documented on a northern long-eared bat (*Myotis septentrionalis*) (USFWS 2010b). However, bats at this location did not exhibit signs of the fungal infection characteristic of WNS-positive locations, nor was mortality or other visible signs of WNS detected. It may be that WNS was observed shortly after the site had become infected and that future monitoring efforts will result in the observation of the visible signs of WNS that have been detected in the Northeast. Or, it may be that survival will be greater in other parts of the Indiana bats range based on variables not yet understood (e.g. latitude, moisture or temperature within the hibernacula, etc.).

WNS-affected bats exiting caves prematurely in the northeast U.S. tended to experience lower ambient temperatures than are typical in the action area. It is currently suggested that most of these individuals starved due to increased arousal throughout hibernation. Normally, bats arouse from torpor 1-2 times each month during the winter. WNS affected bats arouse significantly more often as they are trying to clean the fungus (*G. destructans*) from their skin and fur. Many biologists currently believe that the fungus irritates the bats to the point of arousal, because it invades the dermal layers and presumably causes itching. However, a recent article by Cryan, et

al (2010) suggests that it may be dehydration associated with wing damage that causes the arousal. Regardless of the reason, irritation or dehydratation, WNS-infected bats are observed flying out of the hibernacula in search of food and water. Insect availability is low or non-existent in the winter months in the northeastern U.S. but, in the best scenario, would be considered unreliable in the southeast region, including most of the action area. It is possible that WNS-affected bats in similar situations further south may have greater survival due to higher ambient air temperatures resulting in later ingress into the hibernacula and earlier egress out of the hibernacula (e.g., bats in more southern climates may not require the same fat reserves as bats in northern climates). Although unreliable, the greater availability of insects in southern climates may also provide some relief to those individuals leaving the hibernaculum early in search of food and water. Because of the high degree of uncertainty surrounding the potential effects of WNS throughout the Indiana bat's range, the Service is unable to determine the impact WNS will have on Indiana bats within the action area.

Numerous land use activities that affect the Indiana bat and that likely occur within the action area include: timber harvest, ATV recreational use, recreational use of caves, underground and surface coal 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 the Indiana bat. 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 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.

Actions with a federal nexus are routinely evaluated by the Service for potential impacts to federally listed species. As the Indiana bat is considered to occur statewide, all projects reviewed by the Service are evaluated for the potential to adversely affect the Indiana bat. Primary projects types reviewed by the Service in Kentucky include coal mining, transmission/pipeline, communication (e.g. cell towers), development (commercial, residential, institutional) and transportation. Examining data from 2008-2010, the Kentucky Field Office (KFO) estimated that it reviewed between 800 and 1,000 projects annually. Nearly all of these projects are either covered under an existing biological opinion or result in a determination of not likely to adversely affect the Indiana bat. This is expected to be consistent within the action area.

For projects in the action area that were likely to adversely affect the Indiana bat, the Service has issued 18 programmatic and 13 project-specific biological opinions exempting incidental take of the Indiana bat. The programmatic opinions cover:

1. surface coal mining activities,
2. implementation of the land and resource management plans on the Daniel Boone National Forest (four iterations), Hoosier National Forest (two iterations), Wayne

National Forest (three iterations), Jefferson National Forest, and Shawnee National Forest,

3. application of fire retardants on National Forest system lands,
4. transportation projects in Kentucky and Ohio,
5. vegetation management on the Land Between the Lakes National Recreation Area,
6. conservation memoranda of agreement for Indiana bats in Kentucky, and
7. section 10(a)(1)(A) activities in the Southeast Region.

The project-specific biological opinions are for the Fort Knox Military Reservation (3), U.S. Forest Service (3), Federal Highway Administration (5), Mammoth Cave National Park (1) and Army Corps of Engineers (1). The amount of incidental take exempted by these opinions is shown in Appendix C and further discussed in the "Previous incidental take authorization" section of the "Status of the species" section. The following is a brief discussion of those impacts covered under the existing programmatic biological opinions that are active in Kentucky. Programmatic biological opinions in adjacent states are not discussed as the proposed action area encompasses a relatively small portion of the associated action areas and discussion of only the portion that falls within the action area is not practicable.

The Kentucky Department of Natural Resources issues surface and sub-surface coal mining permits. Surface coal mining occurs in the Eastern and Western Coalfields of the Commonwealth. As of June 30, 2010, there were 1,938,100 acres in Kentucky under coal mining permits (OSMRE 2010). This includes both surface and subsurface acres. The Service is provided an opportunity to review all Kentucky Department of Natural Resources mining permit applications, and all such applications and issued permits are subject to the 1996 Programmatic Biological Opinion for Surface Coal Mining Regulatory Programs Under the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87) (USFWS 1996). Therefore, any potential adverse effects that may result from coal mining activities within the action area have been accounted for through a separate formal consultation with the Service and, if adverse effects are likely to occur, the subsequent implementation of an Indiana bat protection and enhancement plan by the mining permittee that is designed to avoid and minimize impacts to Indiana bats and is required by the 1996 biological opinion.

The Daniel Boone National Forest (DBNF) manages approximately 700,000 acres within its proclamation boundary. This accounts for approximately 2.8 percent of land within the action area and not more than 6 percent of Kentucky's forestlands. As per the Terms and Conditions of the 2007 revised biological opinion on the implementation of the revised Land and Resource Management Plan (USFWS 2007), the DBNF must monitor and report annually to the Service the number of acres that are subjected to green tree harvests, salvage/sanitation harvests, and prescribed burns during the summer roosting season of the Indiana bat (April 1 to September 15). The DBNF's 2010 incidental take report showed that only 7.3 percent of annually authorized take (in the form of habitat alternation) actually occurred; previous incidental take reports showed 5 percent, 17 percent, 8 percent, 16 percent, 21 percent, and less than 1 percent. An analysis of exempted take on national forestlands is more thoroughly discussed in the "Previous incidental take authorization" section of the "Status of the species" section.

The Kentucky Transportation Cabinet (KYTC) is responsible for the construction and maintenance of state and federal roads across the Commonwealth. As the Indiana bat has potential to occur statewide, projects implemented by KYTC have the potential for adverse effects. That does not mean, however, that these projects actually resulted in adverse effects to Indiana bats. In many cases, surveys were conducted and/or the habitat was removed during the winter months when Indiana bats were not present. In a programmatic biological opinion issued to the Federal Highway Administration (FHWA), the Service has authorized incidental take of the Indiana bat for minor, Federal road construction projects in the Commonwealth where KYTC is likely to adversely affect the Indiana bat. This biological opinion will expire in 2011 but is expected to be renewed/revised by the KFO and FHWA.

For 2006 through 2009, incidental take in the form of habitat removal was exempted on up to 2,684 acres, with specific annual allotments. Of these 2,684 acres exempted, only 311.71 acres (or less than 12 percent) were actually removed. For those projects not qualifying for the programmatic biological opinion or those constructed prior to its issuance, we are unable to determine the acreage of any past or future habitat losses as KYTC does not keep such records. However, most of these projects are subject to independent section 7 consultations, because they typically have a federal nexus (e.g., Federal Highway Administration funding or a Clean Water Act section 404 permit from the U.S. Army Corps of Engineers). As a result, it is unlikely that any adverse effects would result from these projects without first undergoing the Service's review and consultation. Further discussion on the factors affecting the species environment within the action area is provided in the "Status of the species/critical habitat" section of this biological opinion.

The national programmatic biological opinion on the application of fire retardants on national forest system lands does not authorize any incidental take.

The Southeast Regional biological opinion for section 10(a)(1)(A) activities authorizes and quantifies incidental take for traditional research activities and selective euthanasia of listed bats when such euthanasia is associated with WNS monitoring in the Service's Southeast Region. Biologists requesting section 10(a)(1)(A) permits must submit an application that describes their qualifications to the Service prior to permit issuance. The harassment and harm associated with traditional research activities has been a factor influencing the species since research on the species began, and take, in the form of mortality or injury, is limited to five Indiana bats per year. Annual take associated with selective euthanasia is limited to 10 Indiana bats. Activities exceeding this amount will be evaluated under a separate federal action. The Service would expect only a small percentage of that annual take would occur within the action area. The Service does not believe that the activities authorized under the Southeast Regional biological opinion for section 10(a)(1)(A) activities will have any significant effect on the environmental baseline in the proposed action area.

The intra-Service biological opinion on the Service's participation in and approval of an unknown number of voluntary Conservation Memoranda of Agreements with federal and non-federal entities will be superseded by this biological opinion. Since the issuance of the original biological opinion, the Service has entered into agreements that have authorized 1,300 acres of

habitat removal. The biological opinion exempted up to 8,000 acres per year; of the 24,000 acres of habitat removal authorized through 2010, approximately 5% was actually used.

Similar to the discussion of the incidental take exempted rangewide, the Service believes that the take exempted within the action area via section 7 consultations has resulted in short-term effects to Indiana bats and their habitat. These biological opinions made necessary assumptions about the Indiana bat and several (e.g., FHWA/KYTC, USFS/Daniel Boone NF, USFWS/Conservation MOA) appear to have over-estimated the amount of take by a significant amount (> 700%). Therefore, the actual effect of the exempted take is likely less than was assumed by the Service in its incidental take authorizations. As a result, the Service concludes that the aggregate effects of the activities and incidental take and covered by previous biological opinions on the Indiana bat have not degraded the environmental baseline of the species within the action area.

IV. EFFECTS OF THE ACTION

Factors to be considered

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities. While analyzing direct and indirect effects of the proposed action, the Service considered the following factors:

Proximity of the action – We describe known species locations and designated critical habitat in relation to the action area and proposed action;
Distribution – We describe where the proposed 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 proposed 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; and
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 species range and numerous records exist documenting that the species occupies summer and winter habitat 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. Three designated critical habitat areas are located in action area – Bat Cave in Carter County, KY, Coach Cave in Edmonson County, KY, and Wyandotte Cave in Crawford County, IN. No summer habitat has been designated as critical habitat within the range of the species.

The Service's participation in Conservation Agreements will result in two primary effects: (1) protection (through acquisition or deed restriction) and management of Indiana bat habitat throughout the bat's range in the Commonwealth as part of the implementation of the Guidance (i.e., the positive effects) and (2) the destruction and/or degradation of forested Indiana bat habitat as a result of project-specific impacts (i.e., the detrimental impacts). The positive effects are indirect effects intended to minimize and mitigate the detrimental impacts of qualified project impacts covered by Conservation Agreements. These positive effects are expected to provide a variety of results including, but not necessarily limited to, (a) the protection of known summer and winter Indiana bat habitat, (b) the management and conservation of known summer and winter Indiana bat habitat, and (c) the protection and/or restoration of suitable summer and winter Indiana bat habitat that is currently not occupied by the species.

While the detrimental impacts are likely to occur across the action area, the Guidance specifically excludes impacts to hibernacula and requires project-specific evaluation of projects

that may impact areas identified by the Service as sensitive or that impact more than 250 acres of known or potential habitat for the Indiana bat. The areas identified as sensitive include: the one mile radius surrounding priority one and two hibernacula (which would include all designated critical habitat areas), the one-half mile radius surrounding priority three and four hibernacula, impacts within ten miles of any Priority 1 or 2 hibernacula or within five miles of any Priority 3 or 4 hibernacula identified as having less than 60 percent forest cover, and impacts within any known maternity areas with less than 45 percent forest cover. Additionally, project-specific evaluations will be required for proposed impacts within known maternity areas during the period when the young are non-volant. The exclusions described above and the requirement for project-specific reviews under certain circumstances serve to minimize the potential for adverse effects by projects implementing the Guidance and to ensure that improvement to Indiana bat conservation and recovery can be realized to mitigate any losses that occur.

Distribution

The effects of the proposed action will vary depending on the location of the Cooperator's qualified project-specific impacts and the selected avoidance, minimization and 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 proposed action, project-specific impacts, and mitigation measures approved under the proposed action will occur within the action area, and primarily with the geopolitical boundaries of the Commonwealth of Kentucky. Impacts authorized under the original 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 positive effects associated with the selected minimization and mitigation measures will typically occur within the Recovery and Mitigation Focus Area (RMFA) closest to the impact site. The convergence of the minimization and mitigation efforts from one or more projects will maximize the recovery-focused conservation benefits for the Indiana bat in Kentucky and the action area.

Timing

Adverse effects related to the timing of the proposed action cannot be quantified, because the projects which might trigger implementation of the Guidance are driven by external factors (such as market forces) that cannot be predicted. 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 due to the removal of roost trees that may cause mortality of adults and young, 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 maternity areas will require project specific review and may require additional minimization and mitigation measures.

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 Indiana bats are preparing to migrate to their summer roosting areas. For females, this migration may be hundreds of miles (see Status of the Species section). Impacts to Indiana bats during this sensitive period will be minimized by placing a one-mile buffer around all priority one and two hibernacula and a one half-mile buffer around all priority three and four 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 and minimization measures.

Indiana bats are most sensitive to disturbance during hibernation (mid-November through March). Adverse effects to Indiana bats covered under Conservation Agreements will not authorize impacts to hibernacula or hibernating bats. So impacts during this sensitive period are avoided and/or minimized, except for removal of some potential and known forested summer and swarming habitat 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. However, the resulting harm and harassment (e.g., alteration of normal behavior patterns) will not result in the mortality of any Indiana bats but may degrade its habitat through the loss of potential roost trees, the alteration of travel and foraging areas, and other indeterminable habitat-related effects.

Nature of the effect

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

Duration

The majority of the positive effects of the proposed action will be permanent, as will most of the adverse effects associated with each qualified project-specific impacts as defined within a Conservation Agreement. 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 qualified project-specific actions that only temporarily affect forested Indiana bat habitat. These would include forest management projects where forest stands are managed, thinned or allowed to regenerate over time and may have both negative and beneficial effects to the Indiana bat.

Disturbance frequency
The frequency at which qualified 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 we have proposed will be impacted on an annual basis is limited to 2,500 acres. Additionally, individual projects can only disturb up to 250 acres of suitable habitat. Based on these limits, and assuming that these maximum limits actually occur, there could be as few as 10 projects per year. As individual project acreages decline, the number of disturbances per year can increase. Projects covered under Conservation Agreements implemented under the original biological opinion ranged in size from under one acre to over 100 acres. The disturbance frequency cannot be predicted with accuracy because the Service does not control the implementation of qualified 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 and the density of Indiana bats utilizing these areas. While the proposed 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 qualified project-specific impacts and occupy similar habitats within the action area without significant reductions in population size. The proposed action will, at a maximum, affect no more than 0.06 percent of the potential habitat available within the action area and not more that 0.012 percent of potentially available habitat in a given year.

Disturbance severity
The Service has deliberately restricted the qualified project-specific impacts that can be implemented under the executed Conservation Agreements in order to limit the severity of disturbance to the Indiana bat. This is accomplished by excluding projects that impact hibernacula and by requiring project-specific evaluations for those impacts that exceed 250 acres of impact, occur in known maternity areas during the period when young are non-volant (June 1-July 31), or occur in sensitive areas. The areas identified as sensitive include: the one mile radius surrounding priority one and two hibernacula, the one half mile radius surrounding priority three and four hibernacula, impacts within ten miles of any hibernacula identified as having less than 60 percent forest cover and impacts within any known maternity areas with less than 45 percent forest cover. These minimization measures reduce the disturbance severity of the proposed by identifying disturbances that would likely have an increased level of adverse affect 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 proposed action but which also require project-specific reviews, additional minimization and mitigation measures may be required, as appropriate, in the Conservation Agreement.

In most cases, it is unlikely that a project will result in the loss of an individual bat; most adverse effects will be the result of a loss of roost trees, foraging areas and/or travel corridors. In these situations, 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. 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 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 young (16 males and 17 females), three of which were dead. The surviving young were placed in either a man-made bat house near the fallen tree or under loose bark on the downed maple. The placement of young 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 young. 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 bats (60 out of presumably 66) survived the felling of a primary maternity roost during a period of non-volancy in the young; (2) the adults and young responded differently, the adults flew out and the young scattered on the ground after the felling, which allowed the adults to retrieve and relocate the non-volant young; 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. This is important as such a catastrophe is considered to be potentially the most severe disturbance that may occur as a result of the proposed action. Based on this information, the recovery rate for the affected maternity colony would be relatively short, perhaps 2-3 maternity seasons (USFWS 2006b) and is unlikely to have a measurable effect on the population as a whole.

Analyses for effects of the action

Private and Federal entities who enter into Conservation Agreements with the Service will be required to implement the minimization and mitigation measures described in the Guidance. These measures will be part of the effects that projects have on Indiana bats and their habitat. Consequently, the positive effects of implementing the Guidance must be weighed against the anticipated impacts associated with each project-specific impact that chooses to implement the Guidance. Generally speaking, if the positive effects outweigh the adverse effects, a recovery-focused conservation benefit can be expected. However, in some cases, recovery-focused conservation benefits may not be realized immediately, so any assessment must also consider the biological value of both the impacted and conserved habitat over time (e.g., temporal effects). In some instances, implementation of the Guidelines may result in a short-term loss of conservation value, but ultimately result in a net long-term gain in conservation value for the species.

Beneficial effects

Beneficial effects are those effects of an action that are wholly positive, without any adverse effect, on a listed species or designated critical habitat. While the Service anticipates that the proposed action will indirectly provide a recovery-focused conservation benefit to the Indiana

bat; this action cannot be considered wholly beneficial. Cooperators entering into Conservation Agreements with the Service will be implementing avoidance, minimization, and mitigation measures in response to adverse affects to the Indiana bat caused by qualifying projects. An example of this would be the fee-simple purchase and protection of a known Indiana bat hibernaculum in order to minimize and mitigate the adverse affects to the Indiana bat associated with the clearing of suitable swarming habitat.

Direct effects

Directs effects are the direct or immediate effects of the agency action on the species or its habitat. Direct effects include the effects of any interrelated or interdependent actions. Interrelated actions are part of the proposed action and depend on the proposed action for justification. Interdependent actions are those actions that have no independent utility apart from the action under consultation. Future federal actions that are not a direct effect of the action under consideration are not considered in this biological opinion.

Because the proposed action has been defined as the Service's participation in and approval of voluntary Conservation Agreements with Federal and non-Federal entities, there are no direct effects of this action on the Indiana bat, because the act of entering into a Conservation Agreement does not directly cause adverse effects to Indiana bats. The project-specific impacts implemented by the Service's Cooperators under voluntary Conservation Agreements would occur with or without the opportunity to enter into the Conservation Agreements with the Service. Where there is an existing federal nexus, consultation with the Service is available under section 7 and those actions that would occur without a federal nexus could seek an incidental take permit under section 10 of the ESA from the Service but would not be required to do so. Similarly, federal or non-federal Cooperators could choose to implement the minimization and mitigation measures set out in the Guidance without entering into a Conservation Agreement with the Service.

Although it is not a direct effect, the Service's participation in these Conservation Agreements will provide recovery-focused conservation benefits (through the implementation of avoidance, minimization, and mitigation measures) for the Indiana bat while allowing the removal of up to 12,500 acres of known and/or potential habitat throughout the action area over a five-year period. No more than 2,500 acres may be removed in a given calendar year. The effects of habitat removal and implementation of minimization and mitigation measures are indirect from the proposed action, because they occur later in time from the approval of the voluntary Conservation Agreement and are considered in the following section.

Indirect effects

Indirect effects are caused by or result from the proposed action, are later in time and reasonably certain to occur. The Service has identified several likely indirect effects of the proposed action. These indirect effects relate to the adverse affects to Indiana bats from qualified project-specific impacts as identified in the Conservation Agreements and recovery-focused conservation benefits that result from the implementation of minimization and mitigation measures as required by the Conservation Agreements. These indirect effects are discussed in greater detail in the following sections and in the text of previous sections.

Habitat removal - general

The Conservation Agreements entered into by the Service under the proposed action would allow the loss, degradation and fragmentation of up to 12,500 acres of known and potential Indiana bat habitat over a five year period. These 12,500 acres represent approximately 0.06 percent of the over 20 million acres of forestland in the action area. No more than 2,500 acres of habitat loss will be authorized under this biological opinion in a given year. Under the Guidance, which must be followed by entities entering into these Conservation Agreements with the Service, a single project-specific impact may impact up to 250 acres. Project-specific impacts affecting more than 250 acres will require individual evaluations by the Service before the project(s) can be covered under a Conservation Agreement.

Qualified project-specific impacts implemented under these Conservation Agreements have the potential to cause adverse effects on Indiana bats by altering their necessary summer habitat characteristics. During the summer roosting season, Indiana bats, especially females, often roost in live, damaged, and/or dead trees with naturally exfoliating bark (e.g., oaks, elms, and hickories). With regard to the damaged and/or dead trees, it is the physical condition of the tree, not the tree species, which make these trees suitable for Indiana bat 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.

Regardless of how the habitat is removed, Indiana bats in a maternity colony or individually-roosting Indiana bats (i.e., non-reproductive females and males) could be harmed, harassed, 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 Indiana 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) young present (usually between June 1 and July 31). Flightless young would not be capable of leaving their roost tree and, therefore, may be harmed, harassed, and/or killed. Once the young bats become volant, their likelihood of surviving the removal of the habitat in which they are roosting likely increases.

Another adverse effect that may occur is the disturbance of a roosting bat that causes the bat to flush from the roost tree during daylight or otherwise modify its 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 Indiana bat responses to them. For instance, Indiana 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, Indiana 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 young, and other adverse effects. Non-volant young that are abandoned permanently are unlikely to survive.

Alternatively, Indiana 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 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 ft (500 m) 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 (Kurta et al. 2002, Kurta 2005, Barclay and Kurta 2007, Foster et al. 2007), not only in 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 ft (0.6 km) 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.

The Indiana bat does not appear to be particularly sensitive to change within its summer and swarming habitats (See Previous Incidental Take Authorizations and Status of the Species in the Action Area sections above). Most known Indiana bat maternity colonies occur in disturbed landscapes and forest habitat areas of low to moderate canopy cover, and a preponderance of the data on summer roosting and foraging habitat show that Indiana bats appear to select roost trees based on proximity to natural or anthropogenic disturbances. Some examples of this include, among others, (a) the selection of primary roost trees that are in canopy openings that will provide solar exposure and radiant heat for maternity colonies, (b) the preferential use of roost trees within various types of timber harvests in many areas, and (c) the use of edges and tree corridors for travel and foraging.

In addition to habitat loss, project-specific impacts authorized under the proposed action 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 cumulative effects continue to occur.

Habitat removal – summer

Summer habitat for the Indiana bat occurs throughout Kentucky and qualified project-specific impacts implemented under the proposed action may occur anywhere within the action area, with the exception of those areas specifically excluded in the Guidance. Impacts to summer habitat may occur during periods of occupation by the Indiana bat (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. Additionally, the bat must be struck either during the felling or the subsequent fall. If not struck during the felling, volant Indiana 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 Indiana 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. Indiana bats returning to summer roosting areas have low fat reserves after hibernation and migration. Additionally, 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 Indiana bats that are presumably stressed already. The proposed action will authorize the loss of up to 12,500 acres of potentially suitable and known Indiana bat habitat. Therefore, we believe this acreage, combined with the cumulative effects of future State, tribal, local and private actions, may adversely affect the Indiana bat even if the removal occurs when the bat is not physically present.

Habitat Removal - Maternity

The Service analyzed the available forest habitat data for known 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 (Figure 5). While the maternity colonies appeared to occur in the habitat that is available in their range, the Service 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. In order to be protective of the Indiana bat, project-specific impacts occurring in maternity areas with less than 45 percent cover will require project-specific evaluation by the Service before the project(s) can be covered under a Conservation Agreement.

The maternity area for a given colony is evaluated as a 2.5-mile radius from known roost trees or as a 5-mile radius from the capture site, if roost trees are unknown. For a maternity areas defined by the 2.5-mile radius with at least 45 percent available forest cover, the 250-acre project-specific limit for impacts to Indiana bat habitat will result in no more than a 4.4 percent loss of potentially available habitat. If a maternity area is defined by a larger area, has a higher percent cover, and/or the impact is less than 250 acres, those impacts to the potentially available habitat are further reduced. Those maternity colonies with less than 45 percent forest cover will receive extra protection from the Service by the requirement for project-specific evaluations of proposed impacts. This project-specific review will allow the Service to determine if minimization and mitigation measures are appropriate for the proposed impacts and, if minimization and mitigation is appropriate, what level is needed. These determinations and any additional minimization measures that may be needed will be included in the individual Conservation Agreements.

This conservative approach will allow the Service to more closely monitor impacts to maternity areas where available habitat may be, but cannot be definitively shown to be, limited. Of the 61 known maternity colonies in the action area, this threshold will affect 22 colonies or just over one-third of the known maternity colonies. The Service will re-evaluate the 45 percent habitat availability threshold on an annual basis or more frequently if new colonies are discovered to determine which maternity colonies will trigger the additional Service review of projects covered by Conservation Agreements.

Adverse effects to the Indiana bat from the removal of maternity habitat may occur as previously described under the general discussion on the effects of habitat removal. However, the removal of maternity roosting habitat between June 1 and July 31, while the young are non-volant, is when the likelihood of mortality is highest. Given the available acreage within maternity areas and the small project sizes approved under this action, it is unlikely that any of the projects implemented under these Conservation Agreements would result in the loss of an entire maternity colony. Additionally, project-specific review is required for all projects within known maternity habitat that would occur during this timeframe. While the loss of an occupied primary maternity roost would result in the greatest immediate impact, the loss of multiple alternate roost trees could cause displaced individuals to expend increased levels of energy while seeking out replacement roost trees. If this increased expenditure occurred during a sensitive period of a bat's reproductive cycle (e.g., pregnancy) it is assumed 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. It has been 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 do give live birth may have pups with lower birth weights or their pups may have delayed development (i.e., late into the summer). This could in turn affect the overwinter survival of the 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.

Habitat Removal – Fall

There are 147 known hibernacula in the action area with uncertain (17), historic (13), or extant (117) Indiana bat populations. This includes three caves designated as Critical Habitat, Wyandotte Cave, Bat Cave and Coach Cave. The Guidance specifically excludes impacts to caves and other potential hibernacula. In addition to avoiding impacts to hibernacula, the Service has identified those areas within a one mile radius of priority one and two hibernacula as sensitive areas that require additional, project specific evaluations before qualified project-specific impacts could occur under a Conservation Agreement. The same is true for the one-half mile radius around priority three and four hibernacula. In addition to limiting impacts to hibernacula and within their immediate vicinity, impacts proposed by Conservation Agreement cooperators that occur within a swarming area where the percent of available forest cover falls below 60 percent will require project-specific evaluations by the Service before the project(s) can be covered under a Conservation Agreement.

The swarming habitat for a given hibernaculum includes the 10-mile radius for priority 1 and 2 (P1 and P2) sites and a five-mile radius for priority 3 and 4 sites (P3 and 4), surrounding the

entrance. Qualified project-specific impacts with impacts within identified swarming habitat are limited to a maximum single project impact of 250 acres, which amounts to approximately 0.4 percent (P1 and P2 sites) or 0.8 percent (P3 and P4 sites) of the available potential habitat assuming the minimum 60 percent forest cover. For impacts within swarming areas with higher percent forest cover and/or that impact less than 250 acres, the percent of potential habitat lost decreases. Those projects with impacts in swarming habitat with less than 60 percent cover will be individually evaluated by the Service to determine the appropriateness of the mitigation and minimization measures for that project. As with the maternity areas, these additional provisions/restrictions will allow the Service to more closely monitor impacts to swarming areas where available habitat may be, but cannot be definitively shown to be, limited. The Service will re-evaluate the 60 percent habitat availability threshold on an annual basis or more frequently if new hibernacula are discovered to determine which hibernacula will trigger the additional Service review of projects covered by Conservation Agreements.

Swarming is a sensitive period for Indiana bats 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 by reduced survival and/or reproductive success. These stressors are anticipated, though to a lower extent, even when the bats are not present on site during the removal of the habitat.

These impacts will be minimized through the use of the Guidance which requires individual review of projects with impacts within one mile of P1 and P2 hibernacula and within one half mile of P3 and P4 hibernacula. As previously discussed, proposed impacts within swarming areas with lower habitat availability will require project-specific review.

Habitat Removal – Winter
No winter habitat will be removed or impacted under the proposed action.

Habitat Removal – Spring Staging
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 Indiana bats are preparing to migrate to their summer roosting areas. For females, this migration may be hundreds of miles (see Status of the Species section). Impacts to Indiana bats during this sensitive period will be minimized by placing a one mile buffer around all P1 and P2 hibernacula and a one-half 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 by the Service under the proposed action to determine the appropriateness of the mitigation and minimization measures.

Global climate change

Qualified projects that are implemented under the proposed action are likely to result (directly and/or indirectly) in the emission of greenhouse gases (GHG). While it is likely that the observed increase in global average temperatures is due to the observed increase in human-induced GHG concentrations, the best scientific data available today does not allow us to draw a causal connection between specific GHG emissions and effects posed to the Indiana bat, nor is there sufficient data to establish that such effects are reasonably certain to occur.

At present, there is a lack of scientific or technical knowledge to determine a relationship between activities that produce, distribute or facilitate production or distribution of petroleum products and the effects of the ultimate consumption of these products. Furthermore, there is no traceable nexus between the ultimate consumption of petroleum products and any particular effect to listed species or their habitats. Consequently, the GHG emissions resulting from the consumption, production and/or distribution of that petroleum do not constitute an indirect effect to the Indiana bat as a result of this proposed action.

Implementation of the Mitigation Guidance

The Service expects the recovery-focused conservation benefits provided by the Conservation Agreements and Guidance to be greater than the minimization measures typically implemented during section 7 consultations in two ways. First, section 7 consultations only require minimization of adverse effects, which typically is for habitat loss that occurs during the period of occupation by Indiana bats. Most commonly, this involves the removal of suitable roosting and foraging habitat during the summer months. The Guidance supports this minimization approach but also includes provisions for mitigation of adverse effects. Second, impacts to Indiana bat summer roosting and foraging habitat were typically minimized through the use of "seasonal cutting restrictions". These seasonal cutting restrictions avoided direct impacts (e.g., mortality) to Indiana bats and habitats by requiring project proponents to remove forested habitat during the Indiana bat's winter hibernation period (i.e., the habitat is removed while the species is not present). However, seasonal cutting restrictions do not address indirect and/or cumulative effects on the species and its summer habitat. The Guidance addresses these indirect and/or cumulative effects issues by ensuring that winter removal of habitat also requires mitigative conservation measures.

The measures identified as appropriate for use in Kentucky[9] are based on the priority recovery actions contained in the revised draft recovery plan, the Indiana bat location and demographic information available to the Service, and relevant Service regulations, policy, and guidance. The measures include: (1) protecting known and previously unprotected Indiana bat hibernacula, (2) protecting known and previously unprotected Indiana bat maternity and/or swarming habitat, and (3) contributing funding to the Indiana bat Conservation Fund sufficient to achieve identified mitigation needs if other measures are impractical or will be of limited value to Indiana bat conservation and/or recovery. Implementation of these measures will support the conservation strategy and general minimization and mitigation goals for Indiana bats in Kentucky for intra-state projects and within the action area for inter-state projects. As human disturbance to hibernacula and other suitable habitat is one potential threat to Indiana bats that can be limited

[9] The Service will use this Guidance, to the extent appropriate, for its assessment of interstate projects (within 20 miles of Kentucky) where the KFO is the lead Service office and use of the Guidance is acceptable to the adjacent state's field office.

(as compared to natural disasters such as flooding), the protection of suitable Indiana bat habitat is believed to be an effective mitigation measure to offset impacts to known or potential habitat.

Protection of Hibernacula

The Guidance lists protection and management of known P1 and P2 hibernacula as its primary conservation focus. This supports two of the recovery actions listed in the draft revised recovery plan (Service 2007): (1) Conserve and manage hibernacula and their winter populations (Recovery Action 1.1); (2) Reduce threats by purchasing from willing sellers or leasing at-risk privately owned P1 and P2 hibernacula to assure long-term protection (1.1.3). Of the thirty-seven P1 (ten) and P2 (27) hibernacula found within the action area, twenty-two of these are in private ownership, including three P1 hibernacula and nineteen P2 hibernacula (Service, unpublished data). Overall, of the 117 hibernacula within the action area having extant wintering populations of Indiana bats, 79 are in private ownership and only eight are gated. However, since the emerging threat of white-nose syndrome, numerous private owners have agreed to limit or restrict access to the hibernacula on their property. This is relatively new (within the last year) and is likely not a permanent measure to avoid or minimize human disturbance to hibernating bats on private property. For most of the sites in private ownership, the primary threat to the hibernating bats is disturbance from recreational cavers.

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Protection and management of currently unprotected hibernacula is one of the habitat mitigation measures available to Cooperators participating in Conservation Agreements with the Service. The protection and management of these important habitats will avoid or minimize the threat of human disturbance to the Indiana bats. Hibernation is widely considered to be the most sensitive period for Indiana bats. Disturbances during hibernation that cause arousal of the bats are likely to increase metabolic rates, thus increasing the fat stores required for hibernation (Thomas et. al 1990). If the bats are disturbed repeatedly or for long periods of time, it is possible that the fat stores will be depleted prior to the end of hibernation and could result in death. Even if fat stores are sufficient for the hibernation period, the bats may emerge with poor body condition, which could reduce the likelihood of successful migration or result in reproductive failure for the females and reduced survivorship of young. Protection of these hibernacula from unrestricted disturbance will minimize the threat of winter disturbance and the associated risks to the hibernating bats.

Protection of Maternity and/or Swarming Habitat

Protection and management of existing forested habitat is the second minimization and mitigation goal listed by the Service in the Guidance. This goal will support several recovery actions listed in the draft, revised recovery plan (USFWS 2007): (1) Conserve and manage areas surrounding hibernacula (Recovery Action 1.1.4); (2) Purchase from willing sellers or lease privately owned lands surrounding P1 and P2 hibernacula identified as having inadequate buffers (1.1.4.4); (3) Restoration and creation of hibernacula (1.2); (4) Conserve and manage summer habitat to maximize survival and fecundity (2.0); and (5) Monitor and manage known maternity colonies (2.4).

The protection of known maternity and/or swarming habitats is another habitat mitigation measure available to Cooperators to compensate for impacts to known and potential Indiana bat

habitat. The protection of these areas will avoid many of the potential adverse affects to the Indiana bat from the destruction, alternation and fragmentation of habitat that is discussed in the earlier portions of this section regarding habitat removal. Directing these mitigation measures to Recovery Mitigation Focus Areas (RMFA) (see Guidance, Table 1) will help maximize the benefits of the habitat protection and management by linking them with areas in existing conservation ownerships and focusing project-specific mitigation to areas that will provide additive conservation benefits for the species. While the Service will encourage mitigation to occur in the RMFA geographically closest to the impacts, in some situations, the RMFA geographically closest to the impact site may not provide the best minimization or mitigation of the impacts. The Service reserves the discretion to approve mitigation projects at locations where they will provide the greatest conservation and recovery benefits to the species.

Contributing to the Indiana Bat Conservation Fund

Cooperators in these Conservation Agreements who choose not to purchase or protect known hibernacula, maternity or swarming areas are provided with the opportunity to make a contribution to the Indiana Bat Conservation Fund (IBCF). While these funds are held by the Kentucky Natural Lands Trust (a non-profit land trust not directly affiliated with the Service), the expenditure of these funds requires approval from the Service and must be used to achieve the following objectives: (a) summer habitat protection, conservation and restoration; (b) winter habitat protection and enhancement; and (b) priority Indiana 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. Tangible, recovery-focused conservation benefits already provided by the IBCF, include:

1. Protection and management of known Priority 1 and Priority 2 hibernacula.
    a. Installation of gates at three separate entrances to Laurel Cave (Carter Co., KY) a priority 2 hibernaculum.
    b. Repair/reconstruction of a damaged gate at Bat Cave (Carter Co., KY), a critical habitat and priority 1 hibernaculum.
2. Protect and manage known Priority 3 (P3) and Priority (P4) hibernacula.
    a. Repair of a damaged gate at John Henry Cave (Jackson Co., KY) a priority 3 hibernaculum.
    b. Assistance with land acquisition near Limestone Cave, a priority 3 hibernacula and including more than 1500 acres of associated swarming habitat.
3. Fund priority Indiana bat research and monitoring that support the six strategies above and/or Kentucky's Indiana bat populations.
    a. Funding of a tracking study that resulted in the identification of a new maternity colony within Kentucky.

<u>Species response to the proposed action</u>

Numbers of individuals/populations in the action area affected

According to our records, the Indiana bat is known from more than 300 locations within the action area, including 147 hibernacula and 61 maternity colonies. The action area harbored about 212,000 Indiana bats during the 2008-2009 winter hibernation periods. However, an unknown portion of those Indiana bats that winter in Kentucky are known to migrate to summer habitat areas that are outside of the state (KSNPC 2006, unpublished data), and Indiana bats that

winter in other states are known to occupy summer habitat in Kentucky (KSNPC 2006, unpublished data). Presumably, this is true for other states as well, so we cannot determine the number of Indiana bats that are present within the action area during the summer maternity season. Given that the potential adverse affects from the project-specific impacts authorized under the proposed action would be localized and limited to impacts to summer habitat, we do not expect the affects of the proposed action to impact a large number of individuals. This is due to many reasons including, but not limited to, (a) implementation of the minimization and mitigation measures prescribed in the Guidance, (b) limiting the total acreage of potential Indiana bat habitat to be affected by qualified project-specific impacts to 0.06 percent of that available within the action area, (c) requiring individual evaluations of impacts in areas of expected higher Indiana bat densities (e.g., those areas surrounding hibernacula), and (d) limiting individual project impacts to 250 acres (less than two percent of a 2.5-mile radius area).

Sensitivity to Change

The Indiana bat does not appear to be particularly sensitive to change within its summer and swarming habitats (See Previous Incidental Take Authorizations and Status of the Species in the Action Area sections above). Most Indiana bat maternity colonies occur in disturbed landscapes and forest habitat areas of low to moderate canopy cover, and a preponderance of the data on summer roosting and foraging habitat show that Indiana bats appear to select roost trees based on proximity to natural or anthropogenic disturbances. Some examples of this include, among others, (a) the selection of primary roost trees that are in canopy openings that will provide solar exposure and radiant heat for maternity colonies, (b) the preferential use of roost trees within various types of timber harvests in many areas, and (c) the use of edges and tree corridors for travel and foraging.

This is not true, however, for winter hibernation habitat. Indiana bats appear to be particularly sensitive to changes in microclimatic conditions within hibernacula and to disturbances during hibernation (See Historic Abundance and Hibernation Habitat sections above), which are the primary reasons cited for the species' historic population losses. The Guidance to be implemented under the proposed action specifically excludes impacts to winter hibernation habitat.

Resilience

For the proposed action, the authorized disturbances from qualified project-specific impacts will be relatively small compared to the action area and the species' range, widely distributed within the action area, and minor in severity. The species' resiliency to natural and anthropogenic disturbances has been demonstrated in a variety of contexts (See "Previous incidental take authorizations" and "Status of the species in the action area" sections above). In most cases of which we are aware, Indiana bat maternity colonies have persisted after minor or significant disturbances occurred, and the species (both males and females) have shown a natural tendency to routinely shift roost trees and to take advantage of new roosting and foraging opportunities (See "Status of the species" section). We do not believe that the types of disturbances associated with the proposed action (i.e., relatively small compared to the action area and the species' range, widely distributed within the action area, and minor in severity) will significantly affect the species even though it has a relatively low reproductive rate.

Recovery rate

We expect the time required for individual Indiana bats, the Indiana bat population with the action area, and the affected Indiana bat habitat to return to equilibrium after implementation of the proposed action to be negligible. Most adverse effects associated with the proposed action will be localized (i.e., at the project-specific impact site) within the action area, thus having an effect on a smaller percentage of bats known to occur within the action area. Similarly, the small percentage (less than 0.1 percent) of the available potential habitat within the action area that could be adversely affected by the proposed action minimizes the recovery time.

V. CUMULATIVE EFFECTS

Cumulative effects include the combined effects of any future State, local, or private actions that are reasonably certain to occur within the action area covered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation under section 7 of the Act. Additionally, any future Federal, State, local, or private actions that are reasonably certain to occur in the action area, and which are considered in this biological opinion, will require compliance with section 7 of the Act. In particular, many of the large-scale activities that could occur in the action area, such as highway development and mining, would have a federal nexus that would require an independent consultation under section 7 of the Act. As such, they would not be included in this cumulative analysis.

Numerous land use activities that affect the Indiana bat and that 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 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 the Indiana bat. All we can say is that it is possible that these activities, when they occur, 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.

It is important to consider that the Service expects that many of the Cooperators who enter into voluntary Conservation Agreements with the Service and consequently will be implementing the Guidance will be non-federal entities whose proposed actions would occur with or without the proposed action. Without the proposed action, these impacts could not be quantified and would not be mitigated for, because there would be no requirement for consultation under the Act.

VI. CONCLUSION

After reviewing the current status of the Indiana bat; the environmental baseline for the action area; the effects of participating in Conservation Agreements with private and federal entities; and the cumulative effects of the proposed action, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Indiana bat. Critical habitat for the Indiana bat has been designated at a number of locations throughout its range, however, this action does not affect any of those designated critical habitat areas, because proposed actions affecting those areas are excluded from the proposed action, and no destruction or adverse modification of that critical habitat is expected.

Based on our analysis, we do not believe that the proposed action "would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of [the Indiana bat] by reducing the reproduction, numbers, or distribution of [the Indiana bat] (50 CFR 402)." In fact, we believe that neither survival nor recovery will be reduced appreciably for reasons summarized later in this section. Furthermore, the expected outcome of entering into these Conservation Agreements would primarily be positive to Indiana bats and their habitat through the protection, enhancement and/or restoration of hibernacula, swarming and maternity habitats. In addition to those measures previously listed, contributions to the Indiana Bat Conservation Fund may also fund priority Indiana bat research and monitoring needs. These are all important aspects of the proposed action that are expected to provide conservation and recovery gains to the species, improve its chances for recovery, and ensure its survival within the action area and within its range as a whole.

For the proposed action to "reduce appreciably" the Indiana bat's recovery, the proposed action would have to impede or stop the process by which the Indiana bat's ecosystems are restored and/or threats to Indiana bat are removed so that self-sustaining and self-regulating populations can be supported as persistent members of native biotic communities (USFWS and NMFS 1998, page 4-35). We do not believe the proposed project impedes or stops the recovery process for the Indiana bat because:

(a) The species' resiliency to natural and anthropogenic disturbances has been demonstrated (See "Previous incidental take authorizations" and "Status of the species in the action area" sections above). We believe that the proposed action, while potentially resulting in the incidental take of some individuals, is not a significant threat to the species as a whole and, therefore, does not rise to the level of jeopardy. No component of the proposed action is expected to result in harm, harassment, or mortality at a level that would reduce appreciably the reproduction, numbers, or distribution of the Indiana bat. The project-specific impacts to the Indiana bat associated with the proposed action will have minor effects on Indiana bats and would most likely occur with or without the proposed action. Additionally, as a result of the proposed action, these project-specific impacts will be mitigated through the implementation of the Guidance, regardless of the season during which the impacts occur.

(b) The primary threats to the Indiana bat's recovery (USFWS 1983) are destruction and alteration of species' winter hibernation habitat and disturbance of Indiana bats while they occupy that winter habitat. The proposed action does not result in any adverse

effects on Indiana bat winter habitat. Additionally, the implementation of the Guidance is likely to result in the removal of some threats through the protection of winter habitat.

(c) The proposed action is unlikely to result in the loss of Indiana bat maternity colonies. Because maintenance of existing maternity colonies and the creation of new maternity colonies (i.e., evidence of population growth and/or improved habitat conditions) are likely important factors that affect the species' recovery potential, we have identified a number of factors related to the proposed action and discussed in the "Status of the species" and "Effects of the action" sections that lead us to believe that the proposed action will not result in significant losses of individual Indiana bats, and especially maternity colonies. The resiliency to disturbance shown by Indiana bat maternity colonies (See "Previous incidental take authorizations" and "Status of the species in the action area" sections above) is one such factor, which was discussed in (a) above. However, other factors that are designed to protect and/or conserve Indiana bat maternity colonies include incentives to Cooperators to time their impacts within maternity habitat during periods the bats are not expected to be present, mitigative conservation measures for impacts within maternity areas, the identification of maternity areas which have reduced availability of potential habitat, and site-specific evaluations of projects affecting these areas. Additionally, site-specific evaluations are required when the proposed impacts would occur in known maternity areas during the period when the young are non-volant.

For the proposed action to "reduce appreciably" the Indiana bat's survival, the proposed action would have to impede or stop the condition in which a species continues to exist into the future while retaining the potential for recovery (Service and NMFS 1998, page 4-35). We do not believe the proposed action impedes or stops the condition in which the Indiana bat continues to exist while retaining the potential for recovery based on two primary conclusions.

First, we believe that neither the Indiana bat's recovery nor its survival will be reduced appreciably by the loss of up to 12,500 acres of potential habitat, which equals less than 0.1 percent of the potential habitat available within the action area. Where adverse effects will actually occur, the species' ability to persist in the face of these effects is well-documented. Second, the proposed action will authorize incidental take of Indiana bats associated with project-specific actions that may be private or Federal. Any private actions that would not require consultation with the Service and without the proposed action would likely occur, but without the implementation of the Guidance. Federal actions require consultation with the Service and would like include many of the minimization and mitigation measures discussed in this Opinion. However, most project proponents currently opt to minimize impacts to the Indiana bat by implementing the project-specific actions involving the removal or disturbance of summer and swarming habitat during periods when Indiana bats are hibernating. Project-specific actions implemented under the proposed action will require mitigation even for these impacts that are minimized through timing. As a result, the proposed action is unlikely to approve any impacts that would not otherwise occur. The proposed action will result in positive gains for the Indiana bat in the form of research, management, and habitat protection through the mitigation measures required by the proposed action. These gains would be less likely if the proposed action were not implemented.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act 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 that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Service so that they become binding conditions of any grant, contract, or permit issued to an applicant, contractor, or permittee, as proper, for the exemption in section 7(o)(2) to apply. The Service has the continuing duty to regulate the activity covered by this Incidental Take Statement. If the Service (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.

Amount or extent of take anticipated

The Service anticipates incidental take of the Indiana bat will be difficult to detect for the following reasons:

1. The individuals are small and occupy summer habitats where they are difficult to find;

2. Indiana bats form small (i.e., 25-100 individuals), widely dispersed maternity colonies under loose bark or in the cavities of trees, and males and non-reproductive females may roost individually which makes finding the species or occupied habitats difficult;

3. Finding dead or injured specimens during or following project implementation is unlikely;

4. The extent and density of the species within its roosting and foraging habitat in the action area is unknown;

5. Implemented actions will not affect all of the available habitat within a project area or within the action area; and

6. Most incidental take will be non-lethal and undetectable.

However, incidental take of Indiana bats can be expected due to:

1. Loss of suitable roosting trees, foraging habitat and travel corridors;

2. Modification and alteration of suitable roosting trees, foraging habitat and travel corridors;

3. Mortality associated with the loss, modification, and/or alteration of occupied roost trees and occupied foraging habitat and travel corridors resulting from habitat removal activities that will be conducted within occupied Indiana bat habitat.

The level of take identified below may result, because the Service anticipates and has estimated that up to 12,500 acres of habitat removal within forest stands that may contain suitable habitat for Indiana bats will likely be authorized under Conservation Agreements entered into by the Service. Because of the difficulty in determining a level of take based on the number of Indiana bats that will be adversely affected, the Service has decided that it is appropriate to base the level of authorized incidental take on the acreage of suitable habitat that will be affected by project impacts authorized under Conservation Agreements entered into by the Service. Therefore, the level of take anticipated in this biological opinion is all of the Indiana bats on up to 12,500 acres of habitat over a five year period, with no more than 2,500 acres occurring in any calendar year.

It is important to note, however, that we do not expect actual adverse effects and incidental take to occur on all of these potential habitat acres, because we have taken a cautious, conservative approach when determining adverse effects to the species and the amount of incidental take that may occur. We expect this authorized level of incidental take to be a significant overestimate of the actual incidental take of Indiana bats, because it assumes that:

(a) All forest types can be immediately occupied by Indiana bats;
(b) All of the suitable habitat within a project area is being used by Indiana bat; and
(c) All activities are completely deleterious and result in complete loss of habitat values for Indiana bats within a project area.

In contrast, the Service knows that:

(a) Indiana bats do not occur ubiquitously or in a uniform distribution across the action area based on negative survey data;
(b) There are less than 350 known records for the species within the action area – many of which are hibernation records – and both the winter and summer sites are not uniformly distributed across the state; and
(c) Not all of the action area contains potentially suitable or occupied habitat - some potential habitat is too young, too dense, etc.

Collectively, these factors will mean that actual harm and/or harassment of Indiana bats will likely occur on less acreage.

This incidental take statement anticipates the taking of Indiana bats only from the actions associated with qualified projects implemented under Conservation Agreements between the Service and the respective project proponent(s). Incidental take of Indiana bats is expected to be in the form of mortality, harm, and/or harassment and is expected to occur as a result of habitat loss. Although mortality is the least likely form of take to occur due to implementation qualified projects authorized through Conservation Agreements between the Service and the respective project proponent(s), adult or juvenile Indiana bats may be killed during the felling of trees if the felling is done during the summer maternity period and if the species is present. Harm may occur through the habitat alterations that are anticipated to occur because of the action which include, but are not limited to, removal of potential roosting habitat and the accidental scarring or knocking down of potential or occupied roost trees by personnel or equipment. Harassment may occur because of any number of disturbance-related effects outlined in previous sections of this biological opinion. However, likely sources of harassment to Indiana bats include, but are not limited to removal of habitat during periods of inoccupation.

Effect of the take

In the accompanying biological opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the Indiana bat or destruction or adverse modification of critical habitat.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the Indiana bat associated with the Service's participation in and approval of voluntary Conservation Agreements:

1. The Service shall implement the proposed action as described above in this biological opinion.

2. The Service will ensure the amount of incidental take provided to Federal and non-federal entities through their participation in voluntary Conservation Agreements with the Service does not exceed the Indiana bats on 2,500 acres annually and 12,500 acres cumulatively for the total habitat loss limits identified in the Incidental Take Statement above.

Terms and conditions

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

1. The Service shall only enter into Conservation Agreements that comply with the provisions of this biological opinion and the Indiana Bat Mitigation Guidance. This Term and Condition is associated with Reasonable and Prudent Measure 1.

2. The Service shall keep records of the level of incidental take granted under Conservation Agreements and the amount of Indiana bat habitat impacted. This Term and Condition is associated with Reasonable and Prudent Measure 2.

3. The Service shall keep records of the amount of habitat purchased, managed, and protected and the amount of funding contributed to the Indiana Bat Conservation Fund. This Term and Condition is associated with Reasonable and Prudent Measure 2.

4. The Service shall perform audits on select qualified projects implemented by Cooperators to ensure compliance with the Indiana Bat Mitigation Guidance, the respective Conservation Agreement(s), and the allowed incidental take. This Term and Condition is associated with Reasonable and Prudent Measure 2.

5. The Service shall create a map or other geographical tool to allow Cooperators to identify when proposed projects are located within known habitat. This map or tool shall be updated annually or more often as needed so that incidental take within known habitat areas can be tracked. This Term and Condition is associated with Reasonable and Prudent Measure 2.

6. The Service shall perform habitat analyses on known maternity and swarming areas annually or as new land cover data becomes available. These analyses shall be used to identify sensitive areas (e.g., swarming areas with less than 60 percent cover or maternity areas with less than 45 percent cover) where additional protective measures may need to be developed and/or additional impact avoidance must be incorporated into the Conservation Agreement(s). This Term and Condition is associated with Reasonable and Prudent Measure 2.

7. The Service, it cooperators and any of their contractors must take care when handling dead or injured Indiana bats or any other federally listed species that are found in order to preserve biological material in the best possible state and to protect the handler from exposure to diseases, such as rabies. In conjunction with the preservation of any dead specimens, the Service and its contractors have the responsibility to ensure that evidence intrinsic to determining the cause of death or injury is not unnecessarily disturbed. The reporting of dead or injured specimens is required in all cases to enable the Service to determine if the level of incidental take authorized by this biological opinion has been reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead, injured, or sick specimen of any endangered or threatened species, prompt notification must be made to the Service's Division of Law Enforcement at 1875 Century Blvd., Suite 380, Atlanta, Georgia 30345 (Telephone: 404/679-7057). Additional notification must be made by the Service's Kentucky Ecological Services

Field Office at 330 West Broadway, Room 265, Frankfort, Kentucky 40601 (Telephone: 502/695-0468) to the Ecological Services program office at 1875 Century Boulevard, Suite 200, Atlanta, Georgia 30345 (Telephone 404/679-7085). This Term and Condition is associated with Reasonable and Prudent Measure 2.

The Reasonable and Prudent Measures, with their Terms and Conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service believes that an indeterminate number of Indiana bats will be incidentally taken as a result of the proposed action, with incidental take occurring on no more than 12,500 acres of potential and known forest habitat in Kentucky. If, during the course of the action, this level of habitat alteration (leading to incidental take of the Indiana bat) is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the Reasonable and Prudent Measures provided. The Service must immediately provide an explanation of the causes of the taking and review the need for possible modification of the Reasonable and Prudent Measures.

Conservation recommendations

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The Service has not identified any conservation recommendations for this biological opinion.

REINITIATION NOTICE

This concludes formal consultation on the Service's participation in and approval of voluntary Conservation Agreements and their effects on the Indiana bat. As stated in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Service 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 Service's action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation (e.g., data suggests that Indiana bat populations in the Appalachian Mountains, Midwest or Ozark-Central recovery units are following similar population trajectories as the Northeast recovery unit following the arrival of WNS), (C) the Service'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 until reinitiation.

For this biological opinion, the authorized incidental take would be exceeded when the take exceeds 2,500 acres of Indiana bat habitat removal in any one year for a five-year period. The total amount of incidental take covered for this period is 12,500 acres. These are the amounts of habitat that are exempted from the prohibitions of section 9 of the Act by this biological opinion.

This consultation was assigned FWS ID #42431-2011-F-0021. Please refer to this number in any correspondence concerning this consultation.

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APPENDIX A

Revised[1] Indiana Bat Mitigation Guidance for the Commonwealth of Kentucky

Introduction

This guidance is to be used when assessing minimization and mitigation needs for the endangered Indiana bat (*Myotis sodalis*) relative to development, forestry, and other land use or land management projects that have the potential to alter or otherwise affect Indiana bat habitat in Kentucky. The Service will pursue similar minimization goals and options for Indiana bat conservation and recovery during informal and formal consultations with Federal action agencies pursuant to section 7(a)(2) of the Endangered Species Act of 1973 (ESA), subject to the acceptability of the minimization measures to the Federal action agencies. Additionally, the Service will use this Guidance, to the extent appropriate, for its assessment of interstate projects (within 20 miles of Kentucky) where the KFO is the lead Service office and use of the Guidance is acceptable to the adjacent state's field office.

The intent of this guidance is to (1) provide direction to project proponents whose actions have the potential to adversely affect the Indiana bat and (2) enhance conservation and recovery of Indiana bat populations in Kentucky by providing minimization and mitigation for adverse effects to Indiana bats that occur in Kentucky. The guidance is subject to modification as new information relative to the species, its conservation status, and its conservation and recovery becomes available.

Kentucky, like most states, is experiencing significant growth. Projects associated with growth can cause the loss, degradation, and fragmentation of natural habitats as the alteration or development of these formerly natural to semi-natural habitats occur. These types of impacts have the potential to adversely affect the Indiana bat, so project proponents must often determine if potential adverse effects to Indiana bats are likely to occur and, if so, how they can avoid, minimize, and/or mitigate for those adverse effects. If avoidance of all likely adverse effects is not achievable, project proponents must follow these guidelines below to ensure compliance with the ESA and avoid an illegal "take" of Indiana bats, a federally listed species. "Take" of federally listed species is prohibited pursuant to section 9 of the ESA. As a result, the supporting rationale for this guidance is that future recovery, conservation, and mitigation efforts for the Indiana bat undertaken by the Service and others using this guidance will improve conservation and recovery of Indiana bat populations in Kentucky in spite of adverse effects that occur, as these adverse effects would require avoidance, minimization, and/or mitigation.

[1] Revised text shown in blue

Background

Kentucky lies near the center of the Indiana bat's range and contains numerous caves and forestlands known to contain and provide habitat for the species. Five out of the 23 Priority 1 hibernacula identified in the draft, revised Indiana bat recovery plan[2] lie within Kentucky's borders. Three of these hibernacula occur within the Mammoth Cave System, located in the Pennyrile region of the state. Cave researchers have suggested that the Mammoth Cave System historically may have provided winter roosts for millions of Indiana bats.[3, 4] The two other Priority 1 hibernacula are found in Kentucky's Eastern Coalfields[5] with Bat Cave in the northeast portion of Kentucky and Line Fork Cave in the southeast. The expansive karst within much of Kentucky's limestone geology results in numerous caves that historically and currently provide winter habitat for Indiana bats. Over 100 caves (5 Priority 1 and 15 Priority 2) within the state have historic Indiana bat records and 74 of these caves have extant winter populations. Many of these caves occur within areas of existing conservation ownerships, both private and public. Of particular note are the Daniel Boone National Forest that is managed by the U.S. Forest Service, Mammoth Cave National Park that is managed by the National Park Service, Carter Cave State Resort Park that is managed by the Kentucky Department of Parks, and several parcels along Pine Mountain. Like the hibernacula, known maternity colonies are scattered throughout the state with notable clusters of maternity colonies occurring near the Fort Knox Military Reservation, Mammoth Cave National Park, Daniel Boone National Forest, Pine Mountain, the Eastern Coalfields, and along the Ohio River floodplain in the Pennyrile (Mississippian Plateaus) and Jackson Purchase (Mississippi Embayment) regions of the state.

Because Indiana bat records occur broadly across the Commonwealth, nearly any project with suitable habitat has the potential to adversely affect the Indiana bat. The KFO reviews between 800 and 1,000 projects annually for impacts to Indiana bats. The majority of these projects involve the loss of suitable summer roosting and foraging habitat. Projects that impact known winter habitat are rare. Projects impacting known and potential summer and swarming habitats range from large block disturbances such as those associated with surface mining and development projects to linear impacts associated with transmission lines and pipelines. Additionally, the KFO annually reviews numerous impacts that vary in size. Although the small size of some of the disturbances makes direct adverse impacts to Indiana bats less likely, the cumulative and indirect effects of these projects as a whole are or can be detrimental to the species and limit the potential conservation and recovery of the species.

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

[3] Toomey, R.S., III, M.L. Colburn, and R.A. Olson. 2002. Paleontological evaluation of use of caves: a tool for restoration of roosts. Pp. 79-85 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

[4] Tuttle, M.D. 1997. A mammoth discovery. Bats 15:3-5.

[5] Physiographic Regions of Kentucky. Kentucky Atlas and Gazetteer. 3/5/2007 (see Appendix A) http://www.uky.edu/Kentucky Atlas/kentucky-atlasp.html

Explanation of Terms

Throughout this document, certain terms are used repeatedly to describe Indiana bat habitat. For the purpose of this document the Service provides the following definitions:

- "Known habitat" refers to suitable summer or winter habitat located within 10 miles of a documented priority 1 or 2 hibernacula, within five (5) miles of a documented maternity capture record or documented priority 3 or 4 hibernacula, or within 2.5 miles of a documented maternity roost tree or non-maternity capture record.

- "Maternity habitat" refers to suitable summer habitat used by juveniles and reproductive (pregnant, lactating, or post-lactating) females.

- "Non-maternity habitat" refers to suitable summer habitat used by non-reproductive females and/or males.

- "Occupied" refers to suitable habitat that is expected or assumed to be in use by Indiana bats at the time of impact. Please see Appendix D for more information on when habitats are considered occupied.

- "Potential habitat" occurs statewide where suitable roosting, foraging and travel habitat for the Indiana bat exists. Known habitat also includes potential habitat for those currently undocumented uses.

- "Suitable habitat" refers to summer and/or winter habitat that is appropriate for use by Indiana bats.

    - Suitable winter habitat (hibernacula) is restricted to underground caves and cave-like structures (e.g. abandoned mines, railroad tunnels). These hibernacula typically have a wide range of vertical structures; cool, stable temperatures, preferably between 4°C and 8°C; and humidity levels above 74 percent but below saturation.

    - Suitable summer habitat for Indiana bats consists of the variety of forested/wooded habitats where they roost, forage and travel. This includes forested blocks as well as linear features such at fencerows, riparian forests and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Isolated trees are considered suitable habitat when they exhibit the characteristics of a suitable roost tree.

- "Suitable primary maternity roost tree" refers to a dead or partially dead tree that is at least 9 inches DBH and has cracks, crevices, and/or loose or exfoliating bark. Trees in excess of 16 inches diameter at breast height (DBH) are considered optimal for maternity colony roosts, but trees in excess of 9 inches DBH appear to provide suitable maternity roosting habitat.

- "Suitable roost tree" refers to a tree (live or dead) with a diameter at breast height (DBH) of 5 inches or greater that exhibits any of the following characteristics: exfoliating bark, crevices

or cracks. Indiana bats typically roost under exfoliating bark, and in cavities of dead, dying, and live trees, and in snags (i.e., dead trees or dead portions of live trees).

- "Unoccupied" refers to suitable habitat not expected to be in use by Indiana bats at the time of impact. Please see Appendix D for more information on when habitats are considered unoccupied.

Conservation Strategy and General Minimization and Mitigation Goals for Indiana Bats in Kentucky

The Service's Kentucky Field Office will generally rely on the draft, revised Indiana Bat recovery plan and other literature and data available on the Indiana bat to support its conservation and recovery activities for the species. For example, the draft, revised recovery plan's primary recovery actions focus on protection and management of Priority 1 and Priority 2 hibernacula, which will also be the primary conservation focus in Kentucky. However, there are a number of other recovery actions that this guidance supports, including, but not limited to: (a) Conserve and manage hibernacula and their winter populations (Recovery Action 1.1); (b) Reduce threats by purchasing from willing sellers or leasing at-risk privately owned P1 and P2 hibernacula to assure long-term protection (1.1.3); (c) Conserve and manage areas surrounding hibernacula (1.1.4); (d) Purchase from willing sellers or lease privately owned lands surrounding P1 and P2 hibernacula identified as having inadequate buffers (1.1.4.4); (e) Restoration and creation of hibernacula (1.2); (f) Conserve and manage summer habitat to maximize survival and fecundity (2.0); (g) Monitor and manage known maternity colonies (2.4); and (h) Minimize adverse impacts to the Indiana bat and its habitat during review of Federal, state, county, municipal, and private activities under the ESA, National Environmental Policy Act, Fish and Wildlife Coordination Act, and Section 404 of the Clean Water Act (2.6). Collectively, these recovery actions address Indiana bat conservation and recovery needs in both winter and summer habitat. As a result, they provide the foundation that supports this guidance. The Service will use its existing authorities, especially those under the ESA, when implementing this guidance.

Based on the background information above and the available information on the species, its status, and conservation[6], the Service developed a list of general minimization and mitigation goals for Indiana bats in Kentucky. If achieved, these goals would (a) support the conservation strategy discussed above, (b) significantly contribute to Indiana bat conservation and recovery in Kentucky, and (c) act as a guide for determining the appropriateness of any proposed minimization and mitigation measures. The goals are listed below:

Tier 1

1. Protect and manage known Priority 1 (P1) and Priority 2 (P2) hibernacula.

2. Protect and manage existing forested habitat:

[6] The KFO relied heavily on the draft revised Indiana Bat Recovery Plan, state heritage information, and the knowledge of experienced Indiana bat biologists to derive this list, but a number of other sources of information, which are on file in our office, were used.

a. Swarming habitat within 10 miles of a known hibernacula; and/or

b. Summer habitat within 2.5 miles of a documented maternity roost tree or within 5.0 miles of a maternity capture (mist-net) record.

3. Protect and manage additional conservation lands for Indiana bats, especially habitat that is contiguous with or within the proclamation/acquisition/preserve boundaries of existing public and private conservation lands occupied by Indiana bats.

4. Restore winter habitat conditions in degraded caves that exhibit the potential for successful restoration such as, but not limited to, those caves identified as having High Potential (HP) in the draft revised Indiana bat Recovery Plan.

Tier 2

5. Protect and manage known Priority 3 (P3) and Priority (P4) hibernacula.

6. Protect and manage additional conservation lands that are currently suitable for but unoccupied by Indiana bats.

7. Fund priority Indiana bat research and monitoring that support the six strategies above and/or Kentucky's Indiana bat populations.

Tier 1 goals would have priority over Tier 2 goals and are encouraged.

Indiana Bat Recovery and Mitigation Focus Areas

The Service's analyses also resulted in the delineation of Indiana Bat Recovery and Mitigation Focus Areas (RMFAs) within the Commonwealth of Kentucky (Figure 1). RMFAs were identified specifically to support the general minimization and mitigation priorities identified in the previous section and represent areas that:

1. Contain one or more public or protected private lands that are known to support Indiana bat populations;

2. Currently support populations of Indiana bats that are expected to support long-term recovery and conservation efforts of the species;

3. Contain adequate suitable habitat to support recovery and conservation efforts;

4. Provide opportunities for future protection, restoration, enhancement, and/or creation of additional summer and/or winter Indiana bat habitat; and/or

5. In the Service's estimation, contain conditions that generally are expected to contribute to the persistence of the Indiana bat population and habitat into the future.

The identified RMFAs can be categorized as Summer Habitat RMFAs, Winter Habitat RMFAs, or as both and are shown in Table 1. Collectively, these RMFAs are key landscapes for Indiana bat conservation and recovery in Kentucky. Therefore, RMFAs will be those areas where most Indiana bat minimization and/or mitigation efforts will be undertaken or attempted. The Service expects, however, that minimization and/or mitigation efforts may also be undertaken or attempted at locations outside of the Indiana bat RMFAs in circumstances where the conservation and/or recovery benefits to Indiana bats can be clearly identified and justified. The applicability of minimization and/or mitigation efforts outside of RMFAs will be determined on a case-by-case basis in coordination with the Service and will depend on a variety of factors including, but not necessarily limited to, (a) location of the site, (b) the type and quality of the conservation opportunities available, and (c) the existence of new information that would help justify the conservation effort. In addition, minimization and/or mitigation efforts will generally be directed to the RMFA closest to the impact site or to the RMFA that best minimizes and/or mitigates the specific impact(s).

Table 1: Table of Recovery and Mitigation Focus Areas (RMFAs) & Available Habitat Types

RMFA Name and Description	Summer Habitat RMFA	Winter Habitat RMFA
Tygarts Creek-Carter Caves SRP – the assemblage of caves along Tygarts Creek and within Carter Caves SRP, including caves on private lands within 10 miles of Tygarts Creek and/or Carter Caves SRP Primary Conservation Ownership – Carter Caves SRP	no	yes
Daniel Boone National Forest – the area within the DBNF proclamation boundary, including caves and maternity colonies on private lands within 10 miles of the proclamation boundary Primary Conservation Ownership – Daniel Boone National Forest	yes	yes
Pine Mountain – the assemblage of caves along Pine Mountain, including caves and maternity colonies on private lands within 10 miles of the crest of Pine Mountain Primary Conservation Ownership – Kentucky State Parks and Kentucky State Nature Preserves Commission	yes	yes
Mammoth Cave National Park – the assemblage of caves within MCNP, including caves and maternity colonies on private lands within Barren, Edmonson, Hart, and Warren counties Primary Conservation Ownership – Mammoth Cave National Park	yes	yes
Barrens-Fort Knox – the assemblage of caves and maternity colonies in Breckinridge, Bullitt, Hardin, Jefferson, Meade, and Spencer counties Primary Conservation Ownership – Fort Knox, Taylorsville Lake WMA	yes	yes
Big Rivers – the assemblage of caves and maternity colonies in Christian, Livingston, Lyon, Marshall, and Trigg counties Primary Conservation Ownership – Land Between the Lakes NRA, Fort Campbell, and Clarks River National Wildlife Refuge	yes[7]	yes
Lower Ohio River – the assemblage of maternity colonies in Daviess, Henderson, and Union counties Primary Conservation Ownership – Sloughs WMA	yes	no
Mississippi River – the assemblage of maternity colonies in Ballard, Carlisle, Hickman, and McCracken counties Primary Conservation Ownership – Ballard, Boatwright, Doug Travis, and West Kentucky WMAs	yes	no

[7] Maternity colony exists on Fort Campbell in Tennessee.

Types of Adverse Effects That Are Appropriate for Minimization and Mitigation

Based on the importance of hibernacula, the Service determined that development of minimization and mitigation measures would not be appropriate for projects resulting in adverse effects to hibernacula; avoidance of caves and other potential hibernacula is preferred. However, minimization and mitigation of certain adverse effects to hibernacula or potential hibernacula may be appropriate but must be coordinated with the Service. The reasons minimization and mitigation measures would be inappropriate at hibernacula include, but are not limited to:

1. P1 and P2 hibernacula are critical to Indiana bat recovery and conservation;
2. Adverse effects to P1 and P2 hibernacula have the potential to cause significant, (and likely irreversible) negative effects on Indiana bat populations range-wide;
3. Sufficient technology and funding does not currently exist to recreate the habitat conditions that exist in most hibernacula, especially P1 and P2 hibernacula; and
4. Current P3 and P4 hibernacula may have historically been P1 or P2 hibernacula, so allowing impacts to restorable P3 and P4 hibernacula could limit Indiana bat recovery.

Minimization and mitigation measures would be appropriate for most other adverse effects that typically occur in association with development projects in Kentucky. However, certain groups of impacts will require project-specific evaluation by the Service to assess the appropriateness of the minimization and mitigation measures. These groups include:

1. Projects resulting in the loss of more than 250 acres of Indiana bat habitat[8]
2. Projects occurring within 1 mile of a priority 1 or 2 hibernacula[9]
3. Project occurring within ½ mile of a priority 3 or 4 hibernacula[9]
4. Identified hibernacula with percent forest cover less than 60 percent in the swarming buffer surrounding the entrance[8]
5. Identified maternity areas with percent forest cover less than 45 percent[8].
6. Projects resulting in impacts to known maternity habitat between June 1 and July 31. Limited clearing during this time may be approved only after a detailed survey to ensure that no primary maternity roosts would be adversely affected during this sensitive period.

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[8] Analyses by the Service and KDFWR relating to the amount of forested habitat available to known Indiana bat maternity colonies within and adjacent to Kentucky has shown that percent forest cover ranges between 9 and 95 percent with no discernable break in records of occurrence(see Appendix B). Similar analysis of P1 and P2 hibernacula found the percent forested cover between 44 and 86 percent with no discernable breaks (see Appendix C). Based on the data (unpublished USFWS data, 2008), the Service determined that projects that (a) were greater than 250 acres, (b) occurred within the swarming area of a hibernaculum with less than 60 percent forest cover, or (c) occurred within known maternity habitat areas containing less than 45 percent forest cover warranted a separate analysis relative to these guidelines in order to further minimize potential adverse effects to Indiana bats.

[9] Separate analyses for projects within ½ or 1 mile of hibernacula will (a) ensure that impacts to occupied swarming habitat are not underestimated (i.e., Most bat activity occurs close to a hibernaculum entrance, so adverse effects are most likely to occur there.), and (b) will help the Service better determine if direct impacts to known hibernacula are likely.

Determine Habitat Mitigation Need

The following mitigation needs have been identified in order of preference.

1. Protect known and previously unprotected Indiana bat hibernacula[10,11,12]

    a. Purchase or otherwise acquire fee title

    b. Secure perpetual conservation easements and land management agreements

2. Protect known Indiana bat maternity or swarming habitat [10,11,12]

    a. Purchase or otherwise acquire fee title (typically at an acre for acre ratio)

    b. Secure perpetual conservation easements and land management agreements (typically at a ratio of two acres protected for each acre impacted)

3. Contribute funding to the Indiana bat Conservation Fund (IBCF) sufficient to achieve identified mitigation needs.

4. Other activities that will provide a tangible conservation benefit to the Indiana bat may be proposed to the Service for a case-by-case evaluation.

Acceptability of Mitigation and Minimization Measures

The Service defined the terms used in the following table in Explanation of Terms section. Table 2 provides guidance on whether a minimization and mitigation measure can be used for a specific type of action or impact. In some cases, minimizing and mitigating impacts to summer habitat with the protection of winter habitat may be appropriate, but this must be determined on a case-by-case basis. Impacts to known Indiana bat hibernacula will require a project specific analysis of suitable mitigation options and may not be appropriate or allowed under these Guidelines at the Service's sole discretion.

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[10] Property acquired or protected must adjoin or be within the preserve design or acquisition boundary of an existing conservation ownership.

[11] Easement or fee simple lands shall include all surface and mineral rights to the property and clear an unencumbered ownership of these rights. The applicant shall pay for all fees and/or other costs associated with title work, recording, transferring, surveying, and/or acquiring of the easement or property.

[12] Mitigation and minimization measures that involve land acquisition or easement require the donation of the property (or easement) to a conservation organization approved by the Service. Accompanying the donation must be a cash endowment sufficient to provide perpetual management of the preserved lands and any other funds identified by the receiving conservation organization that may be necessary for that entity to accept title or easement (e.g. contaminants surveys, fencing, trash removal, etc.).

Table 2. Table of Project Actions/Impact Types & Types of Appropriate Habitat Mitigation Measures.

<table>
<tr><th>ACTION / IMPACT TYPE</th><th colspan="3">HABITAT MITIGATION MEASURE</th></tr>
<tr><td></td><td>Protect Hibernacula</td><td>Protect Maternity and/or Swarming Habitat</td><td>IBCF Contribution</td></tr>
<tr><td>Summer Habitat Loss</td><td rowspan="3">Contact the Service for review of the appropriateness of these measures.</td><td colspan="2" rowspan="6">These are appropriate minimization and mitigation measures for the impacts listed and any overlapping habitats.</td></tr>
<tr><td>Known maternity habitat</td></tr>
<tr><td>Known other habitat</td></tr>
<tr><td>Potential habitat</td><td rowspan="3"></td></tr>
<tr><td>Swarming Habitat Loss</td></tr>
<tr><td>P1 or P2</td></tr>
<tr><td>P3 or P4</td><td></td></tr>
</table>

Determination of Minimization and Mitigation Amounts

Table 3 below assists project proponents in determining the amount of minimization and mitigation needed to offset the specific impacts of a given project. The project's impact(s) should be divided into the actions or impact types and then quantified to yield the acreage of impact for each action. For impacts where suitable habitat is sparse, each suitable roost tree should be counted, and the number of suitable roost trees should be multiplied by 0.09 acres/tree to determine the acreage of suitable habitat loss (i.e., the single tree method). For impacts involving the loss or alteration of blocks of forested habitat, the acreage of the impact is determined by identifying the perimeter and area of the impact with Global Positioning System or Geographic Information System technology (i.e., the habitat block method). Once the acreage of habitat loss has been determined for each action using the single tree and/or habitat block method(s), the impact information should then be inserted into Table 3 and multiplied by the appropriate multiplier to yield the amount of mitigation required for each action or impact type. The Service will provide assistance to project proponents in determining how the single tree and habitat block methods for calculating impact acreages should be applied on their project(s) so that an accurate mitigation estimate can be determined.

The value of a particular hibernacula or maternity or swarming habitat proposed for protection depends on the circumstances applicable to that particular site. As such, standard multipliers are not provided but must be determined on a case-by-case basis by the Service. Factors that influence the value of a particular protection site include, but are not limited to: the relative significance of the site to the conservation and recovery of the Indiana bat, the quality of the habitat, the level of protection afforded, the degree of risk to the site without the proposed mitigation and minimization measure, and the site's position within the landscape and proximity to RMFAs.

Table 3. Table for Calculation of Impact Acres & Mitigation Acres.[13]

ACTION / IMPACT TYPE	IMPACT ACRES	MULTIPLIER	MITIGATION ACRES
Habitat Loss			
Select Action/Impact Type based on location and current map of Indiana bat Habitat in KY(see Appendix E)		Please see Appendix D to select appropriate multiplier based on location and timing of impact.	
Minimization & Mitigation Measures			
Purchase or protect hibernacula	Value determined on a case by case basis		
Purchase or protect maternity or swarming habitat			
Contribute to IBCF	$2880/mitigation acre[14] (please contact the KFO to confirm current cost per acre)		

Summary

This Guidance has been developed by the Service to provide direction to project proponents whose actions have the potential to adversely affect the Indiana bat and to enhance the conservation and recovery of Indiana bat populations in Kentucky. This will be accomplished by the implementation of the minimization and mitigation measures set forth in this Guidance.

These measures were developed to support the recovery actions identified in the draft, revised recovery plan for the Indiana bat and address both summer and winter habitat. This document also establishes the conservation strategy that the Kentucky Field Office (KFO) will employ, which is the foundation for the Guidance.

The KFO has identified those impacts to the Indiana bat where avoidance is more appropriate than minimization and mitigation as well as those projects that will need individual evaluations to determine if minimization and mitigation measures are appropriate. For any impacts that may be allowed, the level of minimization and mitigation that is established in the Guidance varies according to the relative importance of the habitat type that will be impacted to the conservation and recovery of the Indiana bat and likelihood of take. Recovery and Mitigation Focus Areas have been developed to support the identified minimization and mitigation measures as well as to

[13] The Service determined that impacts to potential habitat during the occupied season require direct replacement of impacted acres. From that point, mitigation ratios were assigned based on the importance of the habitat type to the recovery of the Indiana bat and likelihood for direct versus indirect impacts. Direct impacts (occupied) require more mitigation than indirect impacts for each habitat type.

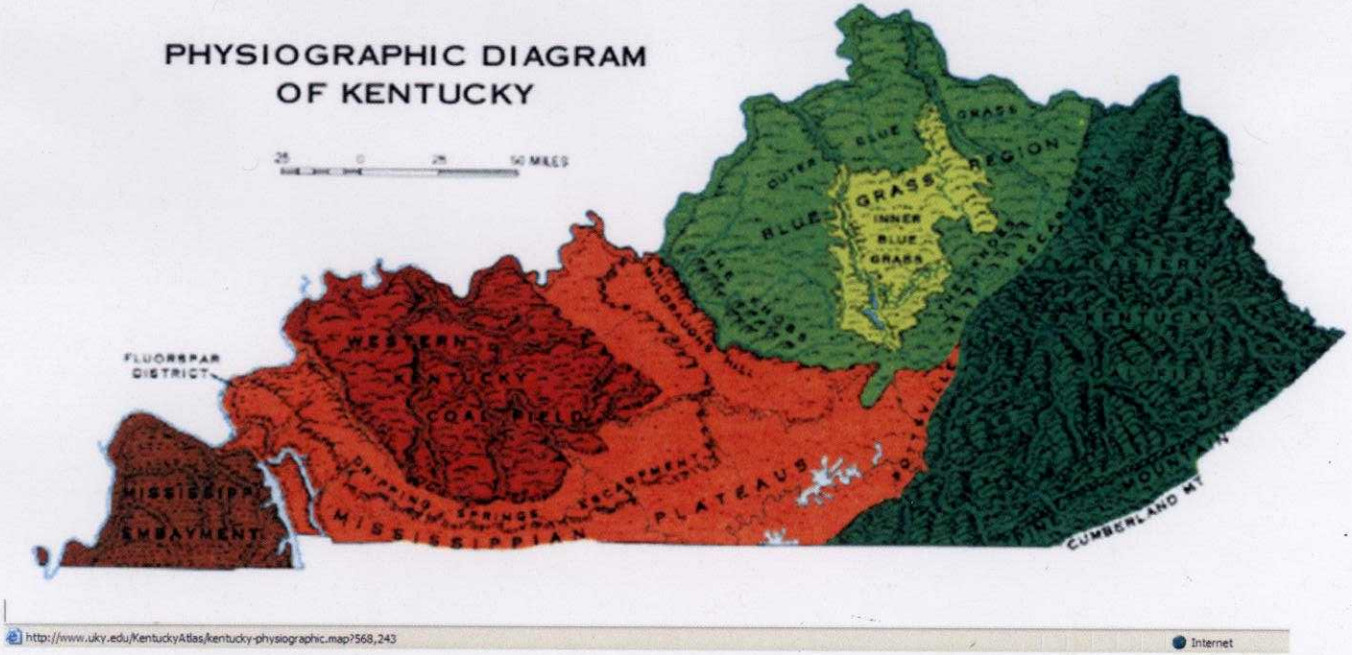
[14] This dollar amount is subject to change based on Kentucky's average value of farm real estate as published annually by the U.S. Department of Agriculture in the Land Values and Cash Rents document. The current value is based on the Land Values and Cash Rents, 2010 Summary released by the USDA in August 2010. (ISSN 1949-1867)

ensure appropriate distribution and implementation of these measures relative to the locations of the impacts.

The protection of hibernacula, swarming and maternity areas is critical to ensuring the conservation and recovery of the Indiana bat. These guidelines set forth a process by which impacts that may directly or indirectly result in adverse effects to the Indiana bat can also help ensure the long-term survival of the species. The Service believes the implementation of this Guidance can help achieve that goal.

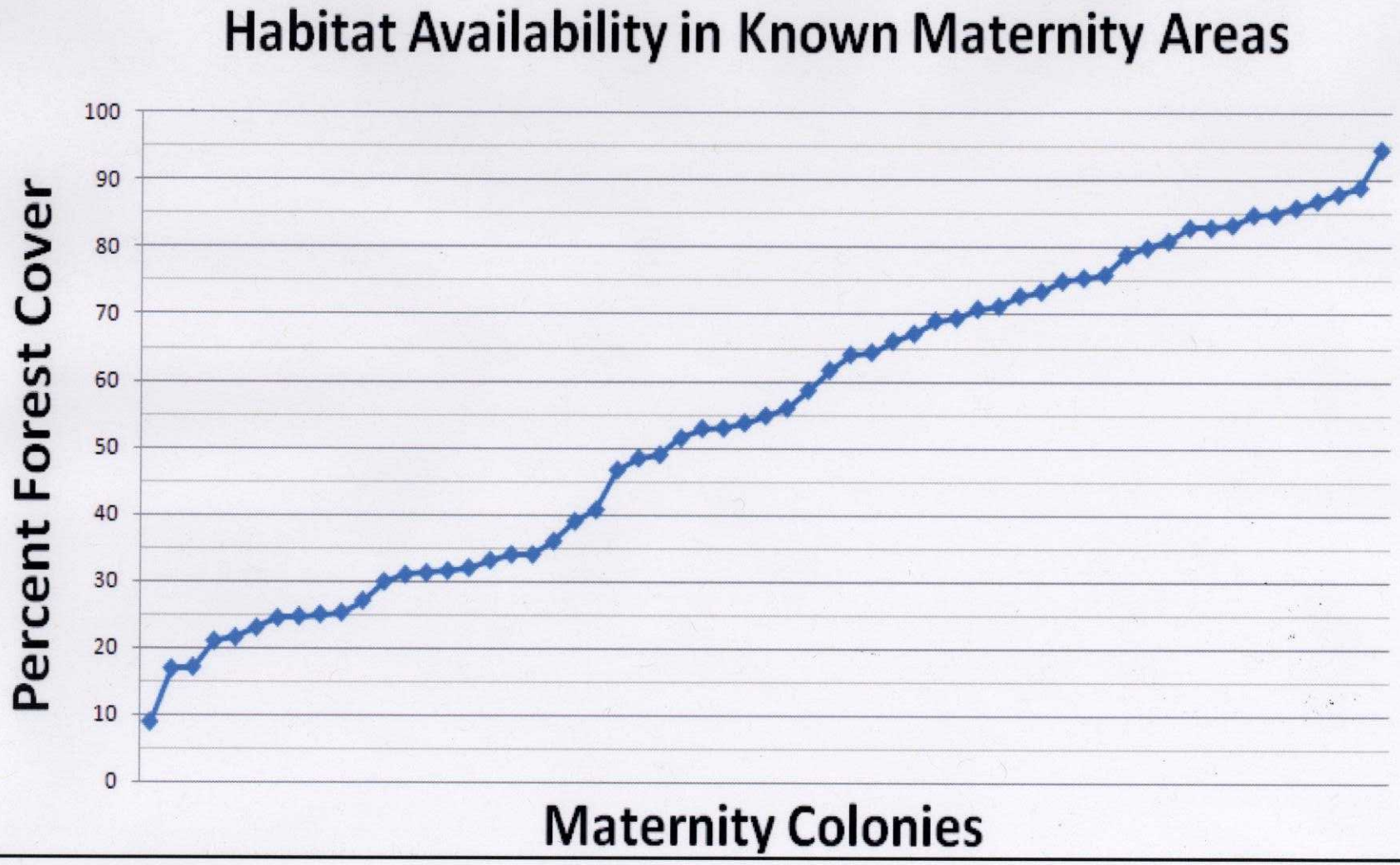
APPENDIX A

Kentucky Atlas & Gazetteer

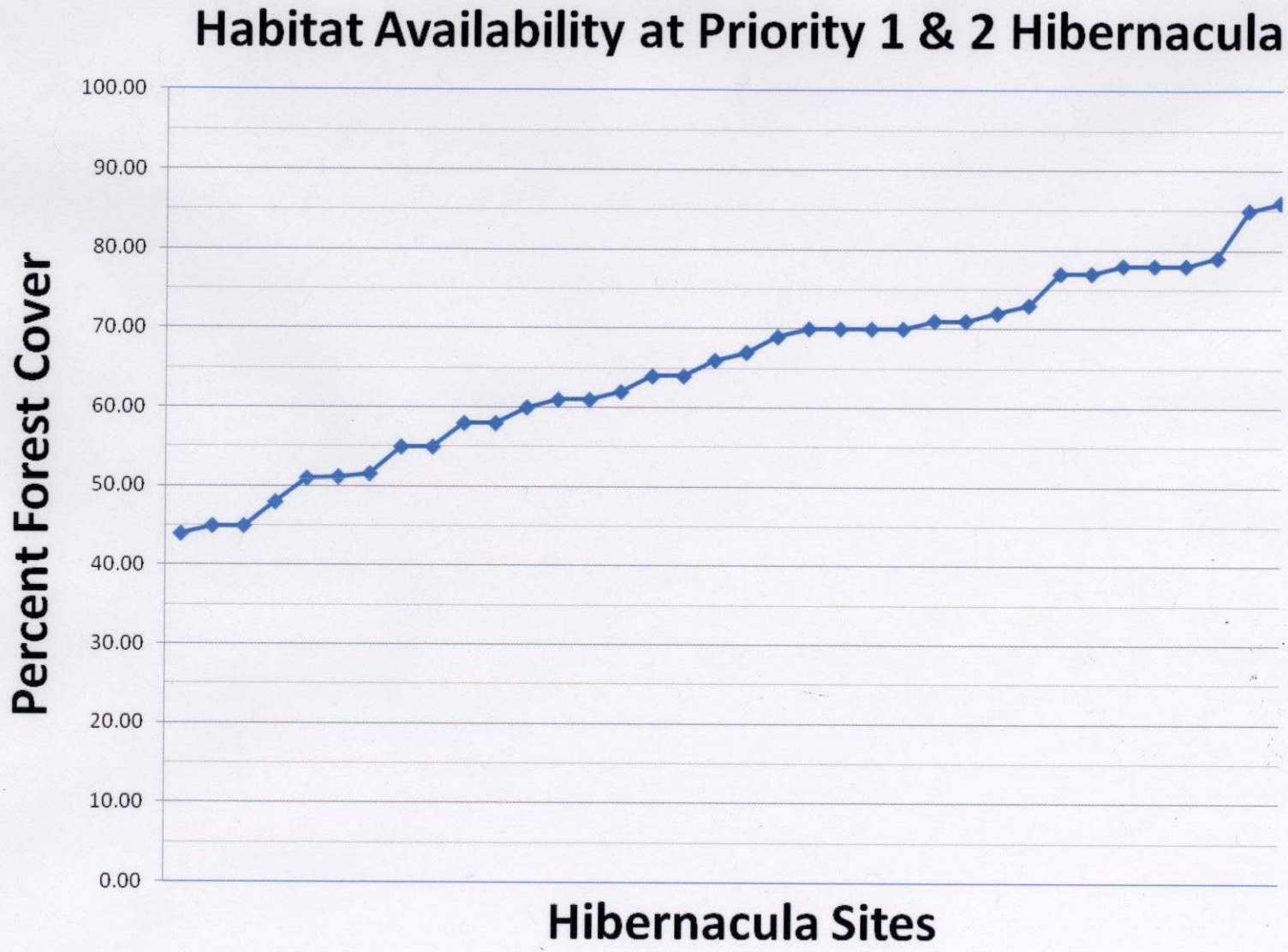


http://www.uky.edu/KentuckyAtlas/kentucky-physiographic.map?568,243 Internet

APPENDIX B


Habitat Availability in Known Maternity Areas
Percent Forest Cover
100
90
80
70
60
50
40
30
20
10
0
Maternity Colonies

APPENDIX C


Habitat Availability at Priority 1 & 2 Hibernacula
Percent Forest Cover
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Hibernacula Sites

APPENDIX D

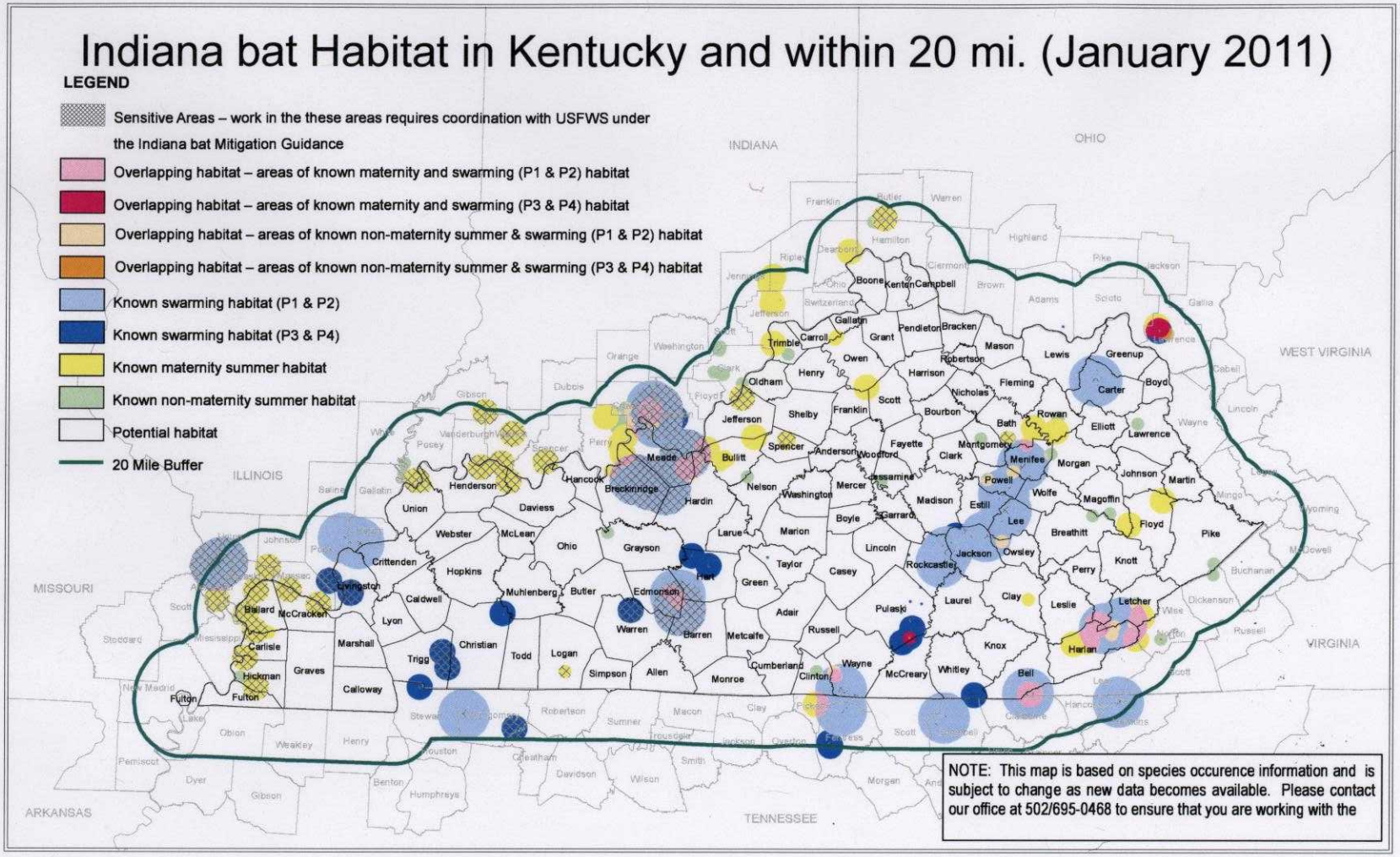
Mitigation Multiplier by Habitat Type and Season

	November 15 – March 31 (all habitats unoccupied	April 1 – August 15 (swarming unoccupied*; potential, maternity** & non-maternity occupied)	August 16 – October 14 (swarming & potential occupied; maternity & non-maternity unoccupied)	October15 – November 14 (swarming occupied; potential, maternity & non-maternity unoccupied)
Known maternity + P1&2 swarming	2.5	3.0 (4.0)*	3.5	3.5
Known maternity + P3&4 swarming	2.0	2.5 (3.5)*	3.0	3.0
Known non-maternity + P1&2 swarming	2.0	2.5 (3.5)*	3.0	3.0
Known non-maternity + P3&4 swarming	1.5	2.0 (3.0)*	2.5	2.5
Swarming P1&2	1.5	2.0 (3.0)*	2.5	2.5
Swarming P3&4	1.0	1.5 (2.5)*	2.0	2.0
Known maternity	1.5	2.0	1.5	1.5
Known non-maternity	1.0	1.5	1.0	1.0
Potential	0.5	1.0	1.0	0.5

*Spring emergence occurs close to the hibernacula entrances in the early spring with females emerging in early to mid-April and males emerging in late April – early May. Swarming habitat within 1 mile of P1 and P2 hibernacula entrances and within ½ mile of P3 and P4 hibernacula entrances will be considered occupied between April 1 and May 14. Projects within these areas require project-specific evaluation by the Service and may require additional mitigation, please see page 7 for more information.

** Projects within known maternity habitat that occur from June 1 through July 31 require project-specific evaluation by the Service, please see page 7 for more information

APPENDIX E


Indiana bat Habitat in Kentucky and within 20 mi. (January 2011)
LEGEND
Sensitive Areas – work in the these areas requires coordination with USFWS under the Indiana bat Mitigation Guidance
Overlapping habitat – areas of known maternity and swarming (P1 & P2) habitat
Overlapping habitat – areas of known maternity and swarming (P3 & P4) habitat
Overlapping habitat – areas of known non-maternity summer & swarming (P1 & P2) habitat
Overlapping habitat – areas of known non-maternity summer & swarming (P3 & P4) habitat
Known swarming habitat (P1 & P2)
Known swarming habitat (P3 & P4)
Known maternity summer habitat
Known non-maternity summer habitat
Potential habitat
20 Mile Buffer
INDIANA
OHIO
WEST VIRGINIA
ILLINOIS
MISSOURI
VIRGINIA
ARKANSAS
TENNESSEE
NOTE: This map is based on species occurence information and is subject to change as new data becomes available. Please contact our office at 502/695-0468 to ensure that you are working with the

APPENDIX B

MEMORANDUM OF AGREEMENT
BETWEEN
THE U.S. FISH AND WILDLIFE SERVICE
AND
THE KENTUCKY NATURAL LANDS TRUST
FOR
THE ESTABLISHMENT AND OPERATION OF THE
INDIANA BAT CONSERVATION FUND

I. PURPOSE

This Memorandum of Agreement (hereinafter "Agreement") is entered into between the United States Fish and Wildlife Service (hereinafter "USFWS"), represented by the Kentucky Field Office Supervisor and the Kentucky Natural Lands Trust (hereinafter "KNLT") represented by the Executive Director, for the purpose of establishing and operating the Indiana Bat Conservation Fund (hereinafter "IBCF"). The IBCF is intended to (a) serve as a mechanism for private individuals, companies, and other organizations to minimize the effects of authorized, project-related Indiana bat incidental take in Kentucky and (b) provide Indiana bat conservation and recovery benefits through the implementation of specific projects funded through the IBCF.

II. BACKGROUND

The Indiana bat was listed as an endangered species on March 11, 1967 (USFWS 1999). A recovery plan was approved on March 1, 1999, and the first revision of the recovery plan is currently in draft and undergoing public review. The historic range of this species consisted of the central and southeastern United States. Current records indicate that the Indiana bat occurs throughout the Commonwealth of Kentucky and may be present statewide at any location containing suitable summer or winter habitat. Within Kentucky, two caves – Bat Cave in Carter County and Coach Cave in Edmonson County – have been designated as critical habitat for the species.

Indiana bats hibernate during winter months in large, cool caves (winter hibernacula) where they form tight clusters, most often containing hundreds of individuals. Each spring the females emerge from the hibernacula and migrate to summer (maternity) habitat consisting of hardwood forests. Maternity colonies formed in these areas typically roost under the exfoliating bark of dead trees or loose bark of living trees. The migration of males is variable with a wider range of summer habitat characteristics. Some males do not migrate, others migrate only a short distance to smaller, warmer caves and others migrate to the same habitat as females.

Based on the characteristics of this life cycle, the intrinsic biological needs of this species include limiting use of fat during hibernation, obligate colonial roosting, high energy demands of pregnant and nursing females, and timely parturition and rapid development and weaning of young. Factors that may exacerbate the bat's

vulnerability because of these constraints include energetic impacts of significant disruptions to roosting areas (both in hibernacula and maternity colonies), availability of hibernation habitat, and connectivity and conservation of roosting-foraging and migration corridors.

Major reasons for the decline in Indiana bat populations include channelization of streams, impoundment of waterways and associated flooding of bottomland forests, deforestation and fragmentation of forested habitat, application of insecticides, destruction or improper gating of winter habitat (e.g. mines, cisterns, and caves), commercialization of caves, and vandalism of cave habitat (Barbour and Davis 1974; USFWS 1999, 2004; Slone and Wethington 2001).

A variety of activities that are otherwise legal have the potential to cause direct, indirect, and cumulative adverse affects to the Indiana bat that could result in the illegal take of Indiana bats. Such take is prohibited by section 9 of the Endangered Species Act. The establishment of the Indiana Bat Conservation Fund will provide a mechanism to fund actions that will promote the conservation and recovery of the Indiana bat while minimizing the direct, indirect, and cumulative effects adverse effects that can occur as a result of development and other activities.

III. AUTHORITY

This Agreement is hereby entered into under the authority of the Endangered Species Act of 1973, as amended (hereinafter "Act"), (16 U.S.C. 1534 *et seq.*), wherein USFWS is responsible for the listing and recovery of wildlife listed under the Act, and cooperating with State and Federal agencies and others to achieve recovery of listed species. In addition, USFWS is authorized to provide assistance to, and cooperate with, private organizations in activities that provide for the management, conservation, and protection of fish, wildlife, and plant resources (Fish and Wildlife Act of 1956, 16 U.S.C. 742 f (a)-754, and the Fish and Wildlife Coordination Act, 16 U.S.C. 661-66c).

KNLT is a non-profit statewide land trust working with partners to secure funds for the protection of natural land and its long-term stewardship and to serve as a resource and partner to other land trusts and conservation groups. KNLT focuses on establishing protected migratory corridors in areas containing large concentrations on rare species, including the Indiana bat. KNLT is a "qualified organization" within the provisions of Section 170(h) of the Internal Revenue Code of 1986, as amended, is qualified under the laws of various states to acquire and hold conservation easements, and meets the requirements of the Internal Revenue Code as a 501(c)(3) exempt organization. KNLT is governed by a Board of Directors. KNLT's funding comes largely through donations from private charitable foundations and individuals as well as grants from government sources for specific projects.

IV. OBJECTIVES

A. Financial and other contributions to the IBCF are intended to provide a dedicated source of funding that will:
   i. Ensure that the direct, indirect, and cumulative adverse effects to Indiana bat, of otherwise legal activities are adequately addressed;
   ii. Result in tangible conservation and recovery benefits to the Indiana bat;

B. The IBCF shall be used to fund projects important to the conservation and recovery of the Indiana bat including, but not limited to:
   i. Summer habitat protection, conservation, and restoration;
   ii. Winter habitat protection and enhancement; and
   iii. Priority Indiana bat research and monitoring needs.

V. SPECIFIC OBLIGATIONS OF THE PARTIES

A. USFWS Obligations – USFWS will:

   i. Direct Deposits to the IBCF and provide KNLT with information that individually identifies the type of deposit and informs KNLT of the Recovery Unit to which the Deposit shall be credited.

   ii. Review projects proposed for funding by the IBCF and approve or disapprove proposed projects as appropriate and consistent with the purpose and objectives of the IBCF. KNLT shall not be excluded from proposing projects.

   iii. Where appropriate, provide information on the IBCF in its public wildlife education efforts.

B. USFWS Acknowledgements – USFWS hereby agrees and acknowledges that:

   i. The IBCF management fee described in Section VI.B represents reasonable consideration for KNLT's efforts under this Agreement. KNLT efforts shall include, but are not limited to: managing, investing and tracking the IBCF, attending meetings regarding oversight and management of the IBCF, and distribution of funds as directed by USFWS.

   ii. Notwithstanding anything contained herein to the contrary, third parties seeking incidental take permits or incidental take statements from USFWS remain ultimately and solely liable for satisfying all of the conditions under any permit or other regulatory document, and KNLT shall not be liable in any manner whatsoever to USFWS or those third parties, or any

other individual or entity whatsoever with respect to satisfaction of any of the conditions or requirements of any permit or other regulatory document. In particular, USFWS acknowledges that, notwithstanding anything contained herein to the contrary, KNLT shall not be responsible for determining whether the acquisitions funded by the IBCF adequately minimize or mitigate for onsite impacts at any site or for determining the relative functional value of land to be acquired pursuant to this Agreement and that KNLT's acceptance of Deposits shall not constitute any direct or implied affirmation that Deposits are adequate mitigation and/or minimization for any purpose.

C. KNLT Obligations – KNLT will:

i. Subject to the terms of this Agreement, accept certified funds directed to KNLT as Deposits into the IBCF for use in achieving conservation projects described above in Section IV: Objectives.

ii. Appoint an individual, KNLT's Project Officer, who will represent KNLT to USFWS in carrying out KNLT's obligations under this Agreement.

iii. Distribute, at the sole direction of USFWS, funding from the IBCF for habitat acquisition, habitat management, monitoring, and research to governmental entities and nongovernmental organizations for USFWS approved Indiana bat projects. KNLT shall have no responsibility for determining the identity or adequacy of the recipient, amount, intended use, or results of any such distributions and this provision shall not be construed either as a direct funding or match requirement for KNLT. Upon receiving written notification from USFWS, KNLT shall have not more than 60 days to distribute those funds to the recipient(s).

iv. In the event any property transferred by KNLT results in proceeds, KNLT shall place all those proceeds into the IBCF to the extent they are attributable to the portion of the property purchased with the IBCF. KNLT is not, however, required to obtain proceeds from any transfer of property obtained pursuant to this Agreement.

VI. **FINANCIAL ADMINSTRATION AND DISTRIBUTION OF THE IBCF -** KNLT will have primary responsibility for administering the funding contained in the IBCF.

A. Certified funds designated for the IBCF shall be deposited into KNLT's general banking account or with an investment agent used by KNLT to manage its funds, subject to the following requirements:

i. KNLT shall open separate budget centers to track the IBCF;

ii. IBCF funding shall be tracked as specified by the USFWS; Deposits from the Kentucky Transportation Cabinet shall be tracked as specified by the USFWS and separate from Deposits made by other entities;

B. As compensation for the management of the IBCF, KNLT shall receive:

i. An annual principal fee of 0.75% that will be prorated and charged monthly, based on the market value of the IBCF.

ii. An annual management fee of 1.25% of the total account balance based on the average monthly value of the IBCF on the last day of that month. This management fee shall be waived to the extent necessary when income from the account is insufficient to cover the management fee.

C. If expenses are incurred by KNLT prior to the termination of this Agreement but are unpaid at the time of termination, KNLT shall be entitled to pay those costs from the IBCF prior to the return of the balance of the IBCF pursuant to Section IX: Modification and Termination.

D. USFWS has the discretion to direct KNLT to make distributions from the IBCF to governmental entities and nonprofit corporations. However, USFWS agrees to work closely with KNLT to ensure that USFWS does not direct disbursements which would adversely impact pending acquisitions, including pending negotiations, or which would result in insufficient funds being available to pay for incurred due diligence products or to pay one or more KNLT Management Fees which are due or which are reasonably expected to be due.

E. KNLT will furnish an annual report to USFWS in the form of a statement of income and expense and will include the total amounts of Deposits, interest income, and categorized disbursements, including but not limited to IBCF management fees, distributions, acquisition costs and expenditures. This report will be due within 30 days of each anniversary date of the effective date of this Agreement or within 30 days of the termination of this Agreement whichever first occurs.

F. KNLT shall maintain books, records and documents directly pertinent to performance under this Agreement in accordance with generally accepted accounting principles and make these available to the USFWS for review and auditing purposes upon the USFWS's written request.

VII. COOPERATION – Both USFWS and KNLT acknowledge that it is their desire to facilitate the processes set forth in this Agreement by open communication and cooperation. Both parties agree to exercise their rights and obligations under, this agreement in good faith. If at any time KNLT has questions regarding its application of the IBCF or selection of a project, USFWS agrees to make itself available for

consultation in a timely fashion. Further, each of the parties hereto agrees whenever and as often as it shall be reasonably requested to do so by any other party hereto, execute, acknowledge, and deliver, or cause to be executed, acknowledged and delivered, any and all further instruments as may be reasonably necessary in order to consummate the transactions provide for in, or contemplated by, this Agreement, and to carryout the purpose and intent of this Agreement.

VIII. OTHER PROVISIONS

A. Each party hereto agrees that it shall be liable for the negligent or wrongful acts or omissions of its employees, agents and assigns only to the extent liable under applicable law. Nothing in this Agreement shall be interpreted or construed as constituting a waiver by any party of sovereign immunity or statutory limitations on liability.

B. This Agreement may not be assigned in whole or in part with out the written approval of the parties. Any such assignment or attempted assignment shall be null and void.

C. Each provision of this Agreement shall be interpreted in such a manner as to be effective and valid under applicable law, but if any provision of the Agreement shall be prohibited or invalid under applicable law, such provision shall be ineffective to the extent of such prohibition or invalidity, without invalidating the remainder of such provision or the remaining provisions of this Agreement.

D. The parties here to do not intend nor shall this Agreement be construed to grant any rights, privileges or interest to any person not a party to this Agreement.

E. No provision of this Agreement shall be interpreted as or constitute a commitment or requirement that either party take actions in contravention of applicable laws, either substantive or procedural.

F. Nothing in this Agreement shall be interpreted as or constitute a commitment or requirement that the USFWS obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341, or any other law or regulation.

G. This Agreement constitutes the full and complete agreement of the parties. No other promises, written or oral have been made by any party hereto.

IX. MODIFICATION AND TERMINATION

A. Modification - This Agreement may only be amended or modified with the written approval of all parties to this Agreement. Modifications may be requested by submitting a written request for such modifications to the other parties. If all

parties approve these modifications in writing, they shall become binding terms of the Agreement.

B. Termination of Agreement - Any party may terminate this Agreement upon 30 days advance written notification to all signatory parties. Termination by KNLT will require the return of any unspent funds remaining in the IBCF to the Service or to the designee of the Service. If the Agreement is terminated, KNLT shall immediately transfer any and all funds in the IBCF to an account specified in writing by USFWS.

X. REFERENCES

A. Barbour, R.W. and W.H. Davis. 1974. Mammals of Kentucky. University Press of Kentucky, Lexington, Kentucky. 322 pp.

B. Slone, T. and T. Wethington (compilers). 2001. Kentucky's Threatened and Endangered Species. Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky. 34 pp.

C. U.S. Fish and Wildlife Service. 1999. Agency Draft Indiana Bat (*Myotis sodalis*) Revised Recovery Plan. Fort Snelling, MN. 53pp.

D. U.S. Fish and Wildlife Service. 2004. An Assessment Framework for Conducting Jeopardy Analyses under Section 7 of the Endangered Species Act. Ecological Services Program, Washington D.C. 10pp.

XI. NOTICE

A. Any notice or other communication required or permitted hereunder shall be deemed to have been duly given if in writing and delivered personally or sent by Federal Express or similar next day nationwide delivery system or mailed by first-class, registered or certified mail, as follows:

If to USFWS:
U. S. Fish and Wildlife Service
c/o: State Field Office Supervisor
330 West Broadway, Suite 265
Frankfort, KY 40601

If to KNLT:
Kentucky Natural Lands Trust
c/o: Executive Director
433 Chestnut Street
Berea, KY 40403

B. A party may change the address to which such communications are to be directed by giving written notice to the other parties in the manner provided in this Article.

C. Any notice or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such times as it is actually received or seven calendar days after it is mailed.

XII. **EFFECTIVE DATE** - This Agreement shall be effective upon the date it is signed by all parties.

By: Virgil Lee Andrews **Date:** 12/7/07
Field Supervisor
U.S. Fish and Wildlife Service

By: Hugh M. Archer **Date:** November 26, 2007
Executive Director
Kentucky Natural Lands Trust

MEMORANDUM OF AGREEMENT
BETWEEN
THE U.S. FISH AND WILDLIFE SERVICE
AND
THE KENTUCKY NATURAL LANDS TRUST
FOR
THE ESTABLISHMENT AND OPERATION OF THE
INDIANA BAT CONSERVATION FUND

MODIFICATION #1

The Memorandum of Agreement for the Establishment and Operation of the Indiana Bat Conservation Fund (IBCF) (hereinafter "Agreement") between the U.S. Fish and Wildlife Service (USFWS) and the Kentucky Natural Lands Trust (KNLT) is hereby modified pursuant to section IX(A). This Agreement modification is necessary in order to improve and simplify the process by which KNLT receives IBCF management fees.

Sections VI(B)(i) and VI(B)(ii) shall be removed from the agreement effective September 30, 2010, and Section VI(B) of the Agreement shall be revised to read:

> B. As compensation for the management of the IBCF, KNLT shall receive a monthly management fee of (i) $1,500 if the balance of the IBCF on the last calendar day of the month is $1,000,000.00 or less, (ii) $2,000 if the balance of the IBCF on the last calendar day of the month is greater than $1,000,000.00 but not more than $3,000,000.00, or (iii) $2,500 if the balance of the IBCF on the last calendar day of the month is greater than $3,000.000.00. The monthly service fee shall be paid on the last calendar day of each month beginning on October 31, 2010.

All other provisions of the Agreement shall remain the same.

This modification is hereby approved and shall be effective beginning on September 30, 2010.

By: Virgil Lee Andrews
Virgil Lee Andrews, Jr.
Field Supervisor
U.S. Fish and Wildlife Service

Date: 10/12/10

By: Hugh N. Archer
Hugh N. Archer
Executive Director
Kentucky Natural Lands Trust

Date: 10/11/10

APPENDIX C

Indiana bat biological opinions including amount and form of incidental take exempted.

PROJECTS	SERVICE OFFICE AND DATE BO ISSUED	INCIDENTAL TAKE (IT) FORM	TAKE EXEMPTED or SURROGATE MEASURE TO MONITOR
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 October 1996	IT by harm, harassment, and killing of all current and future listed species	Unquantifiable
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 sub-lethal 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

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
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
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	210 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.
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 unreproductive 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
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 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

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 210 acres timber harvest and 154 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

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.

Programmatic Biological Opinion for the Monongahela National Forest 2006 Forest Plan Revision	West Virginia FO 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	Indiana FO 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 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 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 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 Note: Replaced March 20, 2004 BO.	Kentucky FO 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 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 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
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	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
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. Up to 10 individual per year killed by selective euthanasia associated with WNS