Biological Evaluation/Biological Assessment
For
Federal Threatened-Endangered and Regional Forester's Sensitive (TES) Animal Species

Cave Hill, Stoneface, Dennison Hollow, and Simpson Barrens Prescribed Burn Project

Hidden Springs Ranger District
Shawnee National Forest
Johnson and Saline Counties, Illinois

Introduction and Proposed Management Action

Forest Service Manual (FSM) Section 2672.41 requires a biological evaluation (BE) and/or biological assessment (BA) be conducted for all Forest Service planned, funded, executed, or permitted programs and activities. The objectives of this BE/BA are to: 1) ensure that Forest Service actions do not contribute to the loss of population viability of any native or desired non-native species or contribute to trends toward federal listing; 2) comply with the requirements of the Endangered Species Act (ESA) so that federal agencies do not jeopardize or adversely modify critical habitat (as defined in ESA) of any federally listed species; and, 3) provide a process and standard to ensure that threatened, endangered, proposed, sensitive, forest listed, and Illinois state listed species receive full consideration in the decision-making process.

The Hidden Springs Ranger District supports known occurrences and suitable habitat for federally proposed-endangered-threatened-regionally sensitive (TES), and other rare animal species, all of which were considered in this analysis. This BE/BA documents the analysis of potential effects of the proposed action to TES and other State of Illinois listed animal species and associated habitat. It also serves as biological input into the environmental analysis for project-level decision making to ensure compliance with the ESA, National Environmental Policy Act (NEPA), and the National Forest Management Act (NFMA).

Table 1. Location of Project.

Proposed Activity	Location	County
Cave Hill, Stoneface, and Dennison Hollow RNA's	Section 34 and 35, T9S R7E; Sections 2, 3, 9, 10, 15,16, 21 and 22; T10S, R7E	Saline
Simpson Township Ecological Area	Sections 10, 11, 14 and 15; T12S, R4E	Johnson

The Hidden Springs Ranger District, Shawnee National Forest, is proposing to conduct prescribed burning on about 3108 acres on three (3) Research Natural Areas (Cave Hill, Dennison Hollow, and Stoneface) and adjacent land; and about 494 acres on one (1) Ecological Area (Simpson Township Barrens) and adjacent land. Burning could be conducted up to five times in a ten year period. Burning , may take place each year for the first two years. Additionally, up to two (2) acres per year may be treated using gas-powered or mechanical

equipment to girdle or cut-n-remove shrubs/saplings-trees (slashing and removal of slash debris from site) to release Mead's Milkweed. The resulting openings in the canopy should be small (less than 2 acres in size). Only one Action Alternative (Alternative Two) is being considered.

No standing dead trees (snags) greater than 6 inches dbh will be cut/removed during the summer maternity period (April 1-September 30). Any suitable Indiana bat live summer roost trees greater than 9 inches dbh that need to be removed will be done only for the purpose of restoring Mead's Milkweed (federally endangered) plants. In the event any suitable live Indiana bat summer roost trees need to be removed, removal will only occur with the following stipulations: 1) between April 1 and September 30: trees will only be girdled and left standing; or, 2) between October 1 and March 31: trees may be girdled, or cut and removed from site. No suitable live summer Indiana bat roost trees will be cut/removed from April 1-September 30. The proposed planned benefits of dormant season burning and removing/girdling trees/shrubs will be to: 1) correct the existing unnatural tree density in historical barren and glade areas to restore them to their natural condition; 2) to improve understory vegetative diversity through reducing canopy allowing a greater amount of solar radiation to reach the forest floor; 3) to improve habitat conditions for rare plant and animal species; and 4) to control non-native invasive plants.

Where feasible, prescribed burning will make use of existing natural and man-made fire control breaks (creeks, streams, roads, trails, etc.). Any new fire control line that must be constructed will be done using minimal disturbance (i.e gas-powered leaf blowers, hand tools, and/or gas-powered chainsaws). No new dozer-constructed fire control line will be created.

No burning will be conducted from May 1 through September 1. Any burning conducted within .25 miles of Equality Cave shall be conducted under conditions that will reduce or eliminate smoke dispersing into this cave, which is a hibernacula for southeastern myotis (*Myotis austroriparius*).

Ignition techniques will be used near rock outcrops/cliff faces so as to minimize the degree of direct contact of fire flames with cliff face surfaces, openings in rock, or other cliff-like habitat. Restrictions on the use of prescribe fire adjacent to the opening of Equality Cave will be implemented to preclude the risk of smoke or other emissions from prescribed burning entering Equality Cave. Specific monitoring requirements will be fully adhered to in order to avoid adversely impacting roosting bats in Equality Cave.

The following "*Design Criteria*" have been built into the action alternatives as part of the "proposed actions" so as to meet Forest Plan standards and guidelines, reduce potential impacts to Forest viability species, compliance with USFWS "*reasonable and prudent measures*" to reduce the likelihood of incidental take to federally-listed species, to reduce adverse impacts to neotropical migratory birds, and to reduce potential adverse impacts to biological diversity.

Table 2. Summarization of "Design Criteria" to be used for the Burn Project.		
Resource Area	**Design Criteria**	**Rationale / Effectiveness**
Wildlife Resource	#1-Avoid removal of live suitable Indiana bat roost trees from 4/1 through 9/30 unless necessary for human safety or resource objectives. Removal can only proceed after exits counts have determined non-use by roosting bats. -Where live suitable Indiana bat summer roost trees must be removed between April 1 and September 30 to enhance Mead's Milkweed, suitable roost trees will be "girdled" and left standing to serve as future bat roost trees and cavity trees for cavity nesting birds.	-Required "*reasonable and prudent measures*" in Dec. 2005 USFWS Biological Opinion to minimize the impacts of incidental take of Indiana bats. -To maintain availability of suitable summer Indiana bat roost trees. -To avoid potential for direct impacts to nesting neotropical migratory birds.
Wildlife Resources	#2-Retain all standing dead trees unless necessary to cut for human safety or to accomplish resource objectives. Standing dead trees greater than 6"dbh that represent suitable Indiana bat summer roost trees cannot be removed from 4/1 through 9/30 unless they are evaluated to document non-use by roosting bats. Snags must be removed within 72 hours after completion of exit surveys.	-Required "*reasonable and prudent measures*" in Dec. 2005 USFWS Biological Opinion to minimize the impacts of incidental take of Indiana bats.
Wildlife Resources	#3-No prescribed burns shall be done from 5/1 through 9/1 in upland forest types.	-Required "*reasonable and prudent measures*" in Dec. 2005 USFWS Biological Opinion to minimize the impacts of incidental take of Indiana bats. -To avoid potential for direct impacts to nesting neotropical migratory birds.
Wildlife Resources	#4-Burning within the vicinity of Equality Cave will be conducted in such a manner (wind direction, fuel moisture, buffer zones, i.e.) so as to prevent smoke from entering the cave and impacting roosting bats. From 9/1-4/30, no burning may take place within 500 feet of the entrance to Equality Cave. Special precautions must be taken so as to prevent the settling of smoke into the cave after sunset.	-Forest Plan standards and guidelines to provide for the conservation of biological diversity. -To minimize the potential for smoke entering winter hibernacula.
Wildlife Resource	#5- Within 50 feet of pond perimeters or dams, any trees to be removed will be directionally felled away from ponds or dams.	-To maintain amphibian habitat in old wildlife ponds.
Wildlife Resources	#7-No trees containing hawk or owl nests will be felled, girdle, removed from April 1 through August 31.	-To reduce the likelihood of direct mortality to nesting hawks and owls.
Wildlife Resources	#8-No trees or shrubs containing known bird nests will be felled from April 1 through August 31.	-To reduce the likelihood of direct mortality to nesting neotropical migratory birds.

EXISTING CONDITION

Past and Present Actions That Have Affected the Existing Situation

The exclusion of fire from these four areas over the past 50 years has permitted the areas to become "unnaturally" overstocked with hardwood trees, saplings, brush and red cedar, creating a more dense canopy condition and densely stocked trees than what is believed to have historically prevailed. The absence of fire has encouraged the establishment of non-native invasive plants, such as Japanese honeysuckle, autumn-olive, Japanese stilt-grass, and multi-flora rose in disturbed areas and along public access ways (i.e. along roadsides, trails, abandoned wildlife openings, and abandoned farmsteads). The resulting action is perceived to have resulted in a reduction in native plant and animal diversity, and the establishment of non-native invasive plants within/adjacent to portions of the four areas. Much of the cliff-line habitat, boulder fields, and rock outcrop areas are un-naturally shaded, thus retarding the development of a diverse forest floor flora and fauna. The unnaturally dense canopy conditions have reduced the quality of summer foraging and roosting habitat for most tree-roosting bats, including the federally

endangered Indiana bat (*Myotis sodalis*), state endangered southeastern myotis , as well as other more common bat species, by increasing the amount of vegetative clutter in the mid-story and overstory.

All four areas have received some degree of dormant season prescribed burning over the past five to ten years, which was conducted for the purpose of enhancing habitat conditions for Mead's milkweed (*Asclepias meadii*), which is a listed by the U.S. Fish and Wildlife Service (USFWS)as "*threatened*".

All four areas are dominated by a mix of upland hardwood forest types. Several small stands of mature yellow pine are also located within portions of the four areas. These areas once were agricultural fields but were planted by the Forest Service in yellow pine for the purpose of stabilizing the soil and to return these once open areas to forested habitat conditions. Scattered small areas, once managed as agricultural fields, were designated to be managed as wildlife openings. However, active management of these scattered wildlife openings was suspended five to ten years ago, allowing them to become invaded by colonizing trees, shrubs, and other herbaceous and woody plant species. Evidence of many of these old wildlife openings can still be seen throughout portions of the project area. Stoneface and Dennison Hollow have well traveled open roads that lie adjacent to the areas, serving as a continual potential source of non-native invasive plants and animals. All four areas lie in close proximity to well traveled open roads.

Unique wildlife habitat features (i.e. caves, karst, wetlands, spring seeps, bogs, rock outcrops, boulder fields, clifflines, etc.) are known to exist throughout portions of all four areas. Rocky cliff-line (sandstone and limestone) habitat is well distributed throughout portions of all four areas. Rock outcrops and boulder fields are also prevalent throughout many portions of the areas. One limestone cave is present (Cave Hill Cave or Equality Cave) within the Cave Hill Area. This cave supports a known population of a Regional Forester's Sensitive bat species (southeastern myotis, *Myotis austroriparius*), as well as several more common species of bats, such as little brown bats (*Myotis lucifugus)*, northern long-eared bat (*Myotis septentrionalis*), big brown bat (*Eptesicus fuscus*), and tri-colored bats (*Perimyotis subflavus*). The federally-endangered Indiana bat (*Myotis sodalis*) has also been documented using the cave during fall swarming (late September and early October).

Fall swarming surveys (harp trapping) conducted by Forest Service wildlife biologists in October of 2008 captured one male Indiana bat (*Myotis sodalis*). A winter survey conducted of the cave in February 2009 failed to find any Indiana bats using Equality Cave as a winter roost site. Forest Service wildlife biologists captured three adult male Indiana bats while harp trapping Equality Cave in early October 2009, providing increasing evidence of the potential use of Equality Cave by Indiana bats.

The increased use of Equality Cave by rare, as well as common bat species is most likely the result from the placement of a cave gate across the entrance to Equality Cave in 2007 to prevent unauthorized entry. A decision was made by the District Ranger to place a protective gate across the entrance to Equality Cave due to: 1) heavy vandalism of the cave by unauthorized public users, 2) the documentation of the cave being used by southeastern myotis, and, 3) to reduce the

potential risk of physical harm/injury/disturbance occurring to rare bats by unauthorized public users.

The predominant overstory forest type of the four areas is upland mixed hardwood. Several relatively small stands of yellow pine are present in some of the areas. Habitat needs for wildlife species dependent upon larger hardwood snag and cavity tree habitat is abundantly available. Large hardwood cavity trees are very abundant throughout the four areas. A variety of hardwood snags are distributed throughout all for areas, with some areas having higher densities of larger diameter snags. The amount of down woody debris varies throughout the four areas, with some areas having very good amounts of larger diameter down woody debris.

The availability of early seral habitat is very limited in the project area. Numerous abandoned wildlife openings are scattered throughout portions of the project area, and represent the only early successional habitat within these four areas. No timber harvesting has taken place within the past 10 years within any of the four areas. There is no other early seral habitat (less then 10 years of age) that exists in the four project activity areas.

Numerous permanent to semi-permanent watered ponds are scattered throughout the four areas, some of which may have fish in them. All of the ponds serve as permanent to semi-permanent aquatic habitat for amphibian species, especially those ponds that have no fish in them. They also serve as an important source for drinking water by bats, as well as use by popular game species such as white-tailed deer and wild turkey.

Project Area and Cumulative Effects Analysis Area

Cumulative effects analysis takes into account all known past actions, present actions, the proposed action, and reasonably foreseeable future actions which could, or will, impact the analysis area.

CUMULATIVE EFFECTS

The *spatial boundary* utilized for conducting the cumulative effects analysis for TES and ISL terrestrial animal species is as follows:

Bats	A five mile radius extending out from the perimeter of the project area boundary for each of the areas.
Timber Rattlesnake	A five mile radius extending out from the perimeter of the project area boundary for each of the areas.
Small Mammals	Johnson and Saline Counties
Birds	A five mile radius extending out from the perimeter of the four project activity areas.

TES Bats: Several Indiana bat research studies have suggested that Indiana bats will travel as far as 2.5 miles from individual primary summer roost trees. A 3 mile radius extending from the project activity area boundary would seem appropriate to cover any potential project-level effects

to Indiana bats. A 5 mile radius extending from the project activity area boundary would seem appropriate for analyzing potential cumulative effects to Indiana bats. The Forest Plan also conducted a comprehensive cumulative effects analysis to the Indiana bat at the Forest-wide scale. This cumulative effects analysis tiers to this analysis in the Forest Plan EIS and the Biological Assessment.

Timber Rattlesnake: A study conducted in New York found that non-gravid females migrate a mean distance of 2.05 km from the den sites, and gravid females less. The study recommended that an area 2.4 km in radius around any hibernacula should be protected. Activity ranges are as large as 500 acres and males have been found as much as 4.5 miles away from their den sites (Brandon et al. 1994). Even though there are no known timber rattlesnake dens present within the four project areas, based on this information, it would seem biologically appropriate to analyze potential cumulative effects to the eastern timber rattlesnake out to a 5 mile radius from the project activity area boundary for each of the four areas. This distance should adequately cover any potential rattlesnake dens within a distance that a rattlesnake could travel and be present in the project activity areas.

Small Mammals: The spatial boundary chosen to analyze cumulative effects to small mammals is the county boundaries for Johnson and Saline Counties. Small mammals in southern Illinois do not embark on seasonal migrations, nor do they tend to move long distances in relatively short periods of time, such as birds. Given this, county boundaries would seem to represent an appropriate biological spatial boundary to use for conducting cumulative effects analysis for this project.

Birds: Since many avian species are long-distance migrants, the appropriate scale for conducting a cumulative effects analysis might be the entire Shawnee National Forest. The 2006 Forest Plan conducted a comprehensive landscape-level scale cumulative effects analysis of potential effects to neotropical migratory birds and MIS birds from the implementation of the Forest Plan. Given that many birds embark on seasonal long-distance migrations, it would be more appropriate to analyze cumulative effects to avian species on a larger scale than at the project-level. This document incorporates by reference the Forest-wide cumulative effects analysis conducted in the Forest Plan EIS on neotropical migratory bird species and regional forester's sensitive bird species. However, cumulative effects were also evaluated for this project effects analysis at the project-level scale. For this analysis, the cumulative effects boundary was conducted at a 5 mile radius extending out from the boundary for each of the four project activity areas. This spatial boundary was selected because it should satisfactorily incorporate the home range of all TES avian species.

The *temporal boundary* utilized for conducting the cumulative effects analysis for terrestrial animal species is five years in the past, and extending out to 50 years into the future. The date chosen for past activities was selected because: 1) little to no activity has taken place within the past five years. The date chosen out into the future was chosen because around 50 years is when a forested habitat begins to take on conditions of a mature forest.

Cumulative effects analysis takes in to account all known past actions, the proposed

action, present actions, and reasonably foreseeable actions, that could or will impact the analysis area.

Past actions in the project area vicinities (both non-Forest Service and Forest Service lands) include: farming (private land); livestock grazing (private lands); land clearing for forestry (private land), timber harvesting; agricultural crop production and livestock grazing (private land), residential and commercial development (private land); pine and hardwood establishment; road construction and road maintenance; use of agricultural pesticides (private land), recreational facility construction and maintenance; abandoned well and cistern filling; Natural Area designation; power line construction and maintenance; user-created equestrian and hiker trails; unauthorized user-created all terrain vehicle (ATV) trails; mining (private land); tree planting; wildlife opening creation and maintenance; timber stand improvement; slashing/felling of shrubs/trees to release Mead's milkweed plants; authorized and unauthorized off-highway recreational vehicle use; hunting; scenic viewing; hiking; wildfire suppression; prescribed burning; unauthorized artifact hunting and collection; pond and wildlife waterhole construction and maintenance; firewood collection; various special uses authorized by the Forest Service; various fisheries, wildlife, and plant monitoring and surveys;hiking; camping equestrian activities; and railroad construction and maintenance.

In 2007, the Hidden Springs Ranger District constructed a cave gate across the opening to Equality Cave to protect rare cave resources. The gate was vandalized in the fall of 2007, but was immediately repaired and has been effective in curtailing unauthorized entry into the cave.

The closest prescribe burn that has been carried out on Forest Service lands is the 542 acre Eagle Mountain Burn, which was burned in 2006. No timber harvesting has taken place on Forest Service lands within the past 5 years within a five mile radius of the project activity areas.

Present action in the project area vicinities (both non-Forest Service and Forest Service lands) include: trail construction and maintenance; trail use-hiking and equestrian; power line maintenance; unauthorized ATV use; timber harvesting (private lands); land clearing for municipal, residential, and commercial development (private lands); wildlife habitat management; agricultural management; livestock grazing; wildfires; prescribed burning; fire suppression; user-created equestrian trails; road construction and maintenance; tree planting; railroad maintenance and use; trail rehabilitation; scenic viewing; hunting; fishing; various fisheries, wildlife, and plant monitoring and surveys; firewood collection; bat surveys of Equality Cave; and, various special uses authorized by the Forest Service.

Reasonably Foreseeable future actions in the project area vicinities (both non-Forest Service and Forest Service lands): include all of the above listed activities and some repeat of the past actions, including land clearing for residential, municipal, and commercial development. The only prescribe burn that is planned for burning in the reasonably foreseeable future, within a five mile radius of the project activity areas, is the Eagle Mountain Burn (542 acres) which is proposed to be burned for the second time in

2009. No timber harvesting is planned to occur on National Forest lands within a five mile radius of the project activity area for the reasonably foreseeable future.

The Forest is currently in the process of preparing a draft Environmental Assessment (EA) to apply herbicides to treat a selective list of non-native invasive (NNIS) plants in selected natural areas across the Forest. None of this activity would take place within close proximity to any of the four natural areas/ecological areas being evaluated in this proposal.

PAST SURVEYS

Portions of the four areas proposed for burning have been surveyed over the years by researchers and biologists from Southern Illinois University (SIU), the Illinois Department of Natural Resources (IDNR), the US Forest Service (USFS), volunteers, and private contractors. Private contractors and USFS biologists conducted small mammal and bird surveys of Cave Hill and Dennison Hollow areas in 1994. Private contractors conducted small mammal, reptile, and amphibian surveys of Cave Hill and Dennison Hollow areas in 1995.

Forest service wildlife biologists have conducted fall bat swarming surveys (harp trapping) at Equality Cave (Cave Hill Cave) since 2006. A winter bat survey was conducted by USFS biologists of Equality Cave in February of 2009. Under a cooperative agreement between the Shawnee National Forest and Southern Illinois University, volunteers and researchers at SIU each year run a bird point transect in the Cave Hill NA

In January 2008, Forest Service wildlife biologist Rod McClanahan conducted a field evaluation of the Cave Hill, Dennison Hollow, and Simpson areas to look for animal sign, and the presence of suitable habitat to be used in making a determination of likelihood of occurrence for federally-listed, regional forester's sensitive, Illinois state-listed, and MIS animal species. On January 14-15, 2008, meandering transects were ran throughout a representative sample area on three of the areas.

Federal Threatened-Endangered and Regional Forester's Sensitive (TES) Animals

Appendix A of this document lists all 14 TES animal species currently known or expected to occur on or near the Hidden Springs Ranger District, Shawnee National Forest. All species on this list were considered in the preparation of the effects analysis for this project.

TES species that may potentially be affected by this project were examined using the following existing available information:

1. Reviewing the list of TES animal species known or likely to occur on the Shawnee National Forest, and their habitat preferences. This review included the U.S. Fish and Wildlife Service current list of endangered, threatened, and proposed species for the Forest.

2. Consulting element of occurrence records (EOR's) for TES animal species as maintained by the Illinois Department of Natural Resources-Natural Heritage Program, and supplied to the Forest.

3. Reviewing sources listed in the references portion of this report.

4. Reviewing the results of any past field surveys that may have been conducted in the project area.

Most T&E species known to occur on the Forest have unique habitat requirements, such as rock outcrops, boulder fields, caves, springs or seeps, cypress-tupelo gum swamps, barrens, bogs or wetlands, old fields, and riparian or aquatic habitats.

A "step down" process was followed to eliminate species from further analysis and focus on those species that may be potentially affected by proposed project activities. Species not eliminated are then analyzed in greater detail. Results of this "step down" process are displayed in the Occurrence Analysis Results (OAR) column of the table in Appendix A. First, the range of a species was considered. Species' ranges and potential occurrences on the Forest are based on county records contained in such documents as "Endangered and Threatened Species of Illinois: Status and Distribution, Volume II – Animals, 1992"; "Additions, Deletions and Changes to the Illinois List of Threatened and Endangered Species-2004"; "2009 Illinois Threatened and Endangered Species by County-Illinois Natural Heritage Database"; Checklist of Endangered and Threatened Animals and Plants of Illinois", Illinois Department of Natural Resources "Biological Conservation Database (February 17, 2005)", "US Fish and Wildlife Service "Distribution of Federally-Listed Threatened (T), Endangered (E), and Proposed (P) Species in Illinois-March 2003", "1999 Checklist of endangered and threatened animals and plants of Illinois", and various Species Conservation Assessments that have been funded by the Shawnee National Forest. These databases and scientific research publications were reviewed for current listings, habitat associations, historical records, and known location information.

For many TES animal species, range information clearly indicates a species will not occur in the project area due to restricted geographic distribution. When the project area is located outside the known range for a species, that species is eliminated from further consideration by being coded as OAR Code "1" in the Appendix A table. For this project, 4 species were eliminated from further consideration because the project area is not within the species known range and no surveys are needed. For the remaining species, likelihood of occurrence was further analyzed using results from past surveys, knowledge of the area, and the potential for the presence of suitable habitat being present within the affected project area.

Some species could not be eliminated from further consideration based on known range and because there were no existing field surveys in portions of the project activity areas. Other then the Indiana bat, no other federally threatened or endangered animal species habitat was observed within the affected project activity areas.

Based on the results of field surveys and knowledge of the area, species were eliminated from further consideration either because of: 1) a lack of suitable habitat in the project area (OAR

code “2”); b) habitat present and the species has been searched for, but has not been found (OAR code “3”); c) the species is located in the project area, but out of the actual area of activity (OAR code “4”); and/or, d) for aquatic species, they are known or suspected downstream of project activity area activity but far enough downstream in the watershed to be considered beyond the projected geographic bounds of having any potentially adverse effects on aquatic habitat (OAR code “7”). Disposition of species considered are documented in the Appendix A table. For this project, 5 species were further eliminated from consideration because of one of the above reasons.

Species Identified as Known or Likely to Occur In the Action Area or Potentially Affected by the Action

Utilizing past surveys and knowledge of the project area, and given the proposed action, those species which would be analyzed and discussed further in this document are those that: a) are found to be located in the proposed activity area (OAR code “5”); b) were not seen during the survey(s) but possibly occur in the activity area based on habitat observed during the survey(s) , field surveys were not conducted when species is recognizable, or no field surveys were completed (OAR code “6”); and/or, c) for aquatic species, they are known or suspected downstream of project or activity area and within projected geographic bounds of having potential adverse effects to aquatic habitat (OAR code “8”).

Based on their known or likely occurrence within or in close proximity to the affected project area, the following 5 species were selected for further effects analysis:

Table 3. TES and ISL Animal Species Analyzed.

OAR Code	Common Name	Scientific Name	Taxa	Status
6	Indiana bat	*Myotis sodalis*	Mammal	Federal Endangered
6	Timber rattlesnake	*Crotalus horridus*	Reptile	Regional Forester’s Sensitive
5	Southeastern myotis	*Myotis austroriparius*	Mammal	Regional Forester’s Sensitive
6	Eastern-small footed bat	*Myotis leibii*	Mammal	Regional Forester’s Sensitive
6	Rafinesque’s big-eared bat	*Corynorhinus rafinesquii*	Mammal	Regional Forester’s Sensitive

POTENTIAL DIRECT, INDIRECT AND CUMULATIVE EFFECTS OF PROPOSED MANAGEMENT ACTION ON TES SPECIES

Federally-listed Animal Species

Indiana Bat

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates colonially in caves and mines in the winter. The species was originally listed as in danger of extinction under the Endangered Species Preservation Act of 1966, and is currently listed as endangered under the Endangered Species Act of 1973, as amended. This rare bat species currently has a US Fish and Wildlife Service USFWS Recovery Priority of 8, which means that the species has a moderate

degree of threat and high recovery potential. As of October 2006, the USFWS had records of extant winter populations at approximately 281 hibernacula in 19 states and 269 maternity colonies in 16 states. The 2005 winter census estimate of the population was 457,000 (USFWS 2007). The initial 2007 winter census estimate of the population is 501,260 (USFWS 2007). The rangewide population is up approximately 42% since a population low in 1995. On average, the population has increased 3.2% per year since 1995; and increased 5.8% per year over the last five years. The initial 2007 population estimate is the highest since 1980 (Krusac personal communication, 2007).

In 2007, a new threat developed that may have implications in the continued population recovery for this species. In 2006, an outbreak of a new fungal agent referred to as "white-nosed syndrome (WNS)" was documented in caves and mines in New York, Vermont, and Massachusetts. Since 2006, this fungal agent has been documented as being present, and causing substantial bat mortality in additional mines and caves in New Jersey, Connecticut, Pennsylvania, West Virginia Virginia. WNS has been documented as causing substantial mortality to little brown bats, northern long-eared bats, tri-colored bats, Indiana bats, big brown bats, and eastern small-footed bats. Total mortality at closely monitored sites with multiple years of infection in New York, Massachusetts, and Vermont has averaged 95 percent (Turner and Reeder 2009). It is suspected that this fungal agent is being spread both from bat-to-bat transmission, as well as by humans on clothing, boots, caving gear, etc. Researchers have named this new fungal agent as *Geomyces destructans*, which is a new species of fungus in the U.S. Scientific studiews supporting the fungus as the sole causative agent of mortality in bats are on-going but not conclusive at this time (Turner and Reeder 2009). Bat researchers are predicting that the range of spread of this fungal agent, and an expansion in bat mortality, will take place in the winter of 2009.

While the overwhelming majority of the bat mortality has taken place in little brown bats, Indiana bats are susceptible to WNS and mortality of Indiana bats has been documented. The continued spread of WNS throughout the range of the Indiana bat could have rangewide population recovery implications.

Wildlife biologists with the US Forest Service and Illinois Department of Natural Resources have been actively monitoring caves and bat populations across southern Illinois to look for the early-warning signs of the presence of WNS. Biologists conducting surveys of wintering Indiana bat populations in February 2009 in known hibernacula in southern Illinois searched for indications of the presence of WNS (unusual number of dead bats, dead bats with characteristic white fungus around nose/mouth/muzzle, bats more active than normal, a shift in traditional roosting location in caves/mines, and/or live bats showing signs of white fungus around nose/mouth, muzzle) in mines and caves in southern Illinois. These surveys failed to detect any sign that WNS was present in Indiana bat hibernacula in southern Illinois.

Forest Service wildlife biologists and biologists from the Illinois Department of Natural Resources harp trapped Rich's Cave, Dutchman Cave, Griffith Cave, Ellis Cave, Brasher Cave, and Equality Cave during the last week of September through the first week in October 2009 to look for any gross physical indications of exposure of bats to WNS. Over 200 bats were captured. Each captured bat was evaluated to determine the presence of tissue scarring on the wings and uropatagium (tail membrane), which serves as an indicator of past exposure to WNS.

No strong evidence was found suggesting the presence of WNS to wintering bat populations in southern Illinois. For the time being, WNS has not been documented in southern Illinois bat populations, nor has it been documented in adjoining states (i.e. Missouri, Indiana, Kentucky).

The Illinois Natural Heritage Survey shows Element of Occurrence Records (EOR) for Indiana bat in Johnson County and Saline County. Forest Service wildlife biologists documented male Indiana bats at Equality Cave both in the fall of October 2008 and 2009 while conducting fall swarming surveys. The entire Shawnee National Forest is considered to represent potential summer range for this species.

In addition to live roost trees and snags, male Indiana bats will also use caves and cliffs for summer roosting sites. In Illinois, bachelor Indiana bat colonies of 1,000-1,500 have been documented using abandoned mines on the west side of the Shawnee National Forest (Widowski, personnel communication, 2007). Other roosts of males have been found in exfoliating bark (Menzel et al. 2001). Caves, cliff lines, boulder fields, and rock shelters are known to be present within portions of the proposed burn areas.

Early researchers considered flood plain and riparian forest to be the primary roosting and foraging habitats used in the summer by the Indiana bat (Humphrey et al. 1977), and these forest types unquestionably are important, especially in the Midwest. The Saline River floodplain habitat is located in close proximity to the Cave Hill NA. Carter (2006) stated that "*In the Midwest, such as southern and central Illinois, USA, maternity colonies are more commonly associated with bottomland, riparian, wetland, or other hydric forest types. Because many large maternity colonies have been observed in hydric habitats of the Midwest, I hypothesize that these are preferred maternity habitats. Moreover, very few large maternity colonies have been located using upland forest habitats within the region. Future conservation efforts for the Indiana bat should focus on protecting and regenerating bottomland habitats along the major river systems of the Midwestern United States. It is within these bottomlands and riparian habitats that future large and long-term maternity colonies will be established*".

Feldhamer and Carter (2005) studied a known summer maternity colony on the Shawnee National Forest in southwestern Illinois in riparian habitat along the Mississippi River bottoms. These researchers concluded that bottomland forest is selected the most by Indiana bats at Oakwood Bottoms, Bluff Lake, and within Southern Illinois. This study also found that the majority of the Indiana bats tracked at Oakwood Bottoms roosted within the closed canopy bottomland forest but moved to open canopy forest of the floodplain to forage, traveling 3-4 km to their preferred foraging areas.

However, other recent studies conducted in more upland forested habitats throughout the U.S. have also shown that a variety of more upland habitat types are also used by Indiana bats for roosting (Clark et al. 1987; Callahan et al. 1997); and upland forest, old fields, and pastures with scattered trees having been shown to provide foraging habitat. Carter (2006) stated "*In the central and southern Appalachians, maternity colonies have been located in upland areas where bottomland habitats are less extensive. However, these colonies are usually characterized by small numbers of bats and ephemeral persistence*".

According to recent telemetry studies, Indiana bats appear to be very adaptable, living in somewhat altered landscapes and are somewhat dependent upon ephemeral resources (dead or dying trees). Recent research indicates that the Indiana bat may, in fact, respond positively to periodic habitat disturbance. In fact, research suggests that the Indiana bat may be a more adaptable species than previously thought. Within the range of the species, the presence/absence of Indiana bats may be governed by the availability of natural roost structures, primarily standing dead trees with loose bark. Some evidence has been documented, however, of Indiana bats readily using artificial roost structures. Indiana bats have been found using wooden "rocket box bat houses" at Oakwood Bottoms.

The suitability of any tree to serve as a roost site is determined primarily by *(1) its condition-dead or alive, (2) the quantity of loose sloughing bark, (3) the tree's solar exposure and location in relation to other trees, and (4) the tree's spatial relationship to water sources and foraging areas*. Research supports the fact that dead trees and live trees with exfoliating bark characteristics play an important role in providing roosting habitat, with dead trees oftentimes playing a major role as preferred roost trees for summer maternity roosts. Carter (2003) conducted a study of the summer habitat use of roost trees by Indiana bats in the Shawnee National Forest of Southern Illinois. In this study, all documented Indiana bat summer roost trees consisted of snags. All Indiana bats roosted under exfoliating bark, except for two roosts which were in crevices of snags, one of which was partially covered by bark. Indiana bats used roosts with low canopy closure levels.

Garner and Gardner (1992) ranked the suitability of trees as potential roosts based solely on bark exfoliation. Trees (trunks and main limbs) with >25% coverage of exfoliating bark were ranked high, >10% and <25% as moderate, and <10% and >1% as low. Trees devoid of loose or peeling bark were ranked as having no current value as roosts. Romme et al. (1995), after reviewing Indiana bat roosting ecology literature, assigned three roost tree class suitability rankings (Class 1 trees, Class 2 trees, and Class 3 trees) to specific tree species based upon their bark characteristic and tendency upon death to provide suitable Indiana bat roosting habitat. The following tree species were ranked as Class 1 trees: silver maple, shagbark hickory, shellbark hickory, bitternut hickory, green ash, white ash, eastern cottonwood, red oak, post oak, white oak, slippery elm, and American elm. Class 2 trees are: sugar maple, shingle oak, and sassafras. Class 3 trees were any not listed above. Hardwood slopes and hardwood bottoms within the project area contain many Class 1 trees, as well as some Class 2 and 3 trees. Pine areas proposed for hardwood restoration generally are devoid of Class 1 or 2 roost trees.

No formally documented Indiana bat winter roost sites (hibernacula) are known to occur within the project area, nor within a five mile radius of the four affected areas. While several male Indiana bats have been captured during fall swarming surveys over the past couple of years at Equality Cave, the US Fish and Wildlife Service does not, at this time, recognize Equality Cave as an Indiana bat hibernacula, since no Indiana bats have been found roosting within the cave.

The closest known Indiana bat hibernacula to any of the proposed burn areas is Ellis Cave, which is located approximately thirteen miles to the south of Dennison Hollow NA. Ellis Cave is located on private land. Even though Indiana bats are not known to use Equality Cave (Cave Hill Cave), winter temperatures in many portions of the cave are suitable for use by winter roosting

Indiana bats. No Indiana bat summer maternity roosts are known to occur within or near the proposed project area. A considerable amount of summer bat mist netting has taken place over the past 10 years on the Shawnee National Forest by Forest Service biologists and university researchers. In spite of an extensive amount of netting effort conducted in the most potentially suitable summer habitat types by highly respected and reputably bat biologists, the only known summer maternity roosts thus far documented on the Shawnee National Forest are restricted to the far west side of the Forest.

The Marion Illinois Office of the U.S. Fish and Wildlife Service has provided summer maternity records for both Johnson and Saline Counties on non-Forest Service lands.

Saline County: One summer maternity roost has been documented on private land west of Harrisburg, Illinois along Bankston Creek. Dr. Tim Carter subsequently captured two pregnant females in June of 2004. This site is located approximately 11 miles to the northwest of the Dennison Hollow Natural Area

Johnson County: Summer maternity activity has been documented at two sites in Johnson County along the Cache River in southern Johnson County. A juvenile male Indiana bat was captured in July 1986, and in 2004 Dr. Tim Carter captured an adult lactating female Indiana bat along the Lower Cache River near Karnak, Illinois along the Johnson/Pulaski County line. A female juvenile Indiana bat was captured along the Cache River in July 1985. In August of 2004, Dr. Tim Carter captured three adult non-reproductive females.

All three of these summer maternity sites are associated with wetland bottomland hardwood forest.

It is not known how many Indiana bats stay within the Forest boundaries during the non-hibernating season. However, some information about their habitat use and distribution across the Forest has been obtained. Carroll (2001) and Carter (2003) have recently (1999-2001 and 2002) sampled all likely roosting and foraging habitats across the Forest utilizing mist netting as part of a study with the SNF. Their studies have documented a few male Indiana bats in upland, hardwood forest in Alexander County in the vicinity of abandoned mines used as hibernacula. Their studies have also identified the two, relatively large maternity colonies in Jackson and Union counties on the Forest (USFWS BO, 2005). All of these areas are located a considerable distance to the west/southwest of the project area (over 30 miles).

It appears from the studies and surveys for Indiana bats on the Forest since 1992, including mist net surveys from at least 36 different locations on the Forest, that summer maternity roosting and foraging habitat is confined primarily to hydric, riparian, or bottomland hardwood areas with excessive amounts of mature hardwood tree mortality that are the indirect results of being heavily affected by past and present prolonged flooding. It also appears from these surveys and studies that upland hardwood forests across the Forest at present are not providing high quality or abundant maternity roosting habitat for Indiana bats (USFWS BO, 2005). Mist net locations on the Forest included many of the best riparian and associated uplands. Additionally, no Indiana bats have been captured in mist net surveys in many, non-native pine plantations on the Forest since 1992 (Carrol, 2001, Shawnee National Forest Monitoring Reports, 1992-2002). This

appears to indicate that non-native pines on the Shawnee National Forest are not providing high quality habitats; or, are not used extensively by either male or female Indiana bats as roosting or foraging habitats (USFWS BO, 2005).

Potential summer foraging habitat is scattered throughout the Hidden Springs Ranger District on the Shawnee National Forest, as well as on adjacent private lands. Past research has strongly suggested that the amount of vegetative clutter and canopy density have a bearing on the use of forested areas by foraging Indiana bats. Feldhamer and Carter (2005) documented a major movement of Indiana bats from more closed canopy roosting sites to more open-canopy sites to forage. Brack and Brown (2002) studied the foraging habits of Indiana bats and found that Indiana bats most frequently used agricultural land (44.7%), intermediate deciduous forests (22.6%), and open deciduous forests (19.0%), comprising 86.3% of all habitat types used for foraging during the survey. The bats' activity areas included proportionally more agricultural lands and open forests than were available in the study area. Closed canopy woodlands were not used by foraging bats to the extent they were available in the study area. The study concluded that Indiana bats more frequently used power-line rights-of-way, pasture edges, savannah-like woods, and other openings rather than large, continuous tracts of closed canopy forests.

These findings are consistent with the interpretation of telemetry data in similar studies (Brack 1983, Callahan 1993, Gumbert et al. 2002). All roost trees in these studies were located near forest canopy openings such as open woodlands or pastures, scattered trees of recently logged areas, old logging roads, utility line corridors, and natural drainages. Roost trees were very exposed with little or no canopy. Roosts in closed canopy deciduous forests were often in small openings near open corridor flyways (Brack and Brown 2002). During the summer of 2002, Sparks et al. (2005) radio-tracked 11 Indiana bats near Indianapolis International Airport. While bats preferred woodlands over other available habitats, radio-tracked bats spent nearly 50% of their time foraging over agricultural fields. Bats used riparian corridors to travel throughout a somewhat agricultural landscape.

Menzel et al. (2005) compared bat activity levels in the Coastal Plain of South Carolina among five habitat types: forested riparian areas, clearcuts, young pine plantations, mature pine plantations, and pine savannas. They found relatively low levels of bat activity in upland pine stands, which may be the result of a scarcity of insect prey in these stands. Kalcounis et al. (1999) suggested that bat activity may be lower in coniferous stands because of resins synthesized by conifers as a defense against herbivory may result in lower insect densities.

At the microhabitat scale, vertical structure or "clutter" in forest stands, such as tree boles, branches, and foliage affect bat foraging by impeding detection and pursuit of prey (Owen et al. 2004). The structural complexity of a forest, such as the amount of vegetative clutter (e.g., tree trunks, branches) significantly influences the foraging activity of bats, which in turn influences the presence of bats in that forest. Researchers have found that bat species segregate themselves among forests with high and low densities of vegetative clutter. Closely spaced trees and high densities of certain forests can be a hindrance to flying bats by impeding detection and capture of prey. Too much vegetative clutter may also increase the risk of predation by obstructing a clear path of escape (Avina et al. 2006). Patriquin and Barclay (2003) reported that foraging activity of

Myotis spp. was influenced by vegetation density. *Myotis* spp. as a group, and *M. lucifugus* on its own, foraged more in deciduous clearcuts, specifically at the edge, and in intact forest patches.

Menzel et al. (2005) tracked and determined the home ranges of seven female and 4 male Indiana bats in 1997 and 1998 in Pike and Adam Counties, Illinois. This study highlighted the importance of forested habitat to Indiana bats in agricultural landscapes. Their study also documented the importance of linear landscape features such as riparian corridors and roads to Indiana bats as travel corridors and foraging habitat.

Within the vicinity of the project activity area, potential foraging habitat is widely available in the form of road corridors, utility corridors, somewhat open-canopied hardwood slopes and bottoms, natural forest openings, open cliff-lines, and abandoned farmland on adjacent private lands. Summer foraging habitat is not considered to be limiting on the Forest, with the possible exception of the larger and more remote tracts of mature hardwood forest (i.e. wilderness areas, etc.) or dense pine plantations. However, there is a biological benefit in having quality summer foraging habitat located within a several mile radius of summer roost sites so that bats can be most efficient in the conservation of food energy, growth and development of young of the year, and enhanced summer fat build up.

The results of this analysis concluded that the Indiana bat (*Myotis sodalis*) is the only federally-listed animal species that has the potential to occur within or near the potentially affected proposed project area.

Direct, Indirect and Cumulative Effects to Federally Listed Species

Indiana Bat

In a letter dated December 3, 2005, the USFWS transmitted the Service's Programmatic Biological Opinion (BO) for the proposed 2005 Forest Plan and the Plans effect on federally listed species. With regards to the potential effects on the Indiana bat, the USFWS concluded: "*It is the Service's biological opinion that the 2005 Forest Plan, as proposed, is not likely to jeopardize the continued existence of the Indiana bat*". In addition, the USFWS provided a list of "*Reasonable and Prudent Measures-Terms and Conditions*" which are necessary to minimize the impacts of incidental take of Indiana bats. In order to be exempt from the prohibitions of section 9 of the Endangered Species Act, the Shawnee National Forest must comply with a list of "*Terms and Conditions*", which carry out the reasonable and prudent measures described in the USFWS BO (as listed on pages 88-90 of the BO).

The proposed action will be in full compliance with the "*Terms and Conditions*" of the December 3, 2005 USFWS BO for the 2006 Shawnee Forest Plan, and therefore constitutes compliance with ESA Section 7 requirements. Since implementation of this project will be in full compliance with, and tiers to, the USFWS BO that was issued as a result of formal consultation, and it provides both specific Plan and project level direction, plus no new information has been identified as of this date, implementation of this project is projected to have no effect beyond that which is already disclosed in the Programmatic Biological Assessment issued for the 2005 Revised Shawnee National Forest Land and Resource Management Plan and the 2006 USFWS BO.

Alternative One:

Potential Direct Effects

It is anticipated that implementation of Alternative One will have no adverse direct effects to Indiana bat populations or habitats.

Potential Indirect Effects

This alternative will perpetuate existing roosting and foraging habitat conditions for Indiana bat within the four areas. Over time, it anticipated that as trees become older and die, additional snags will become available, resulting in an increase in large diameter downed logs on the forest floor. Canopy conditions will remain somewhat similar to current conditions into the near future. However, over time, the abundance of small canopy gaps is expected to increase. Within these gaps, shade-tolerant hardwood tree seedlings should become established, gradually transitioning into the future dominant canopy. Over time, and in the absence of fire, there should be a shift in tree species composition in the dominant canopy from shade intolerant, fire adapted, hardmast producing hardwoods to shade tolerant, fire non-adapted, non-hardmast producing hardwoods. Oaks and hickories would be expected to become less prevalent, with an increase in tree species such as red maple, sassafras, sugar maple, blackgum, yellow poplar, sweetgum, and ash. This, in itself, could create forest habitat conditions that are less suitable as Indiana bat summer habitat, due to fewer Class One roost trees present across the landscape. The preponderance of non-native invasive plants would be expected to increase.

In the absence of fire, canopy and mid-story densities should increase over time, providing lower quality summer roosting and foraging habitat. Mid-story and understory shrubs and saplings should increase in abundance, creating lower quality Indiana bat foraging and roosting habitat.

Alternative Two:

Conducting prescribed burning and the felling-removal of trees can have both direct and/or indirect effects upon habitat and individuals.

Potential Direct Effects

Prescribed Burning: Burning in summer Indiana bat habitat from late spring through late summer has the risk of directly affecting Indiana bats by: 1) directly killing roosting bats, either from heat, flames, or smoke, that are present in standing snags or live roost trees during burning operations; 2) disturbance to summer roosting bat, causing roosting bats to vacate occupied summer roost trees; and/or, 3) disturbance to summer male bachelor colonies using caves or mines for summer roosting, causing bats to vacate the summer roost site. Burning conducted during the winter hibernation period has the risk of directly affecting Indiana bats by: 1) disturbing and arousing winter roosting bats from the effects of smoke and other fire emissions into hibernacula, which can result in increased winter mortality.

The timing of annual spring emergence of Indiana bats from their hibernacula may vary across the range, depending on latitude and weather. Based on trapping conducted at the entrances of caves in Indiana and Kentucky, researchers have observed that peak spring emergence of female Indiana bats was in mid-April, while most males were still hibernating (USFWS 2007). Peak emergence of males occurred in early May. In Missouri hibernacula females started emerging in late March to early April, and outnumbered males active at hibernacula entrance during that period (USFWS 2007).

Burning the four areas during the non-summer maternity period (December through late March) would virtually eliminate the potential risk of direct mortality occurring to bats roosting in live or dead roost trees within burned areas. The closer that burning occurs to late spring the greater the chance that individual Indiana bats may be disturbed/impacted by burning, since adult females quite often depart winter hibernacula in early to mid April in search of maternity roost sites. However, burning earlier in the winter hibernation period increases the likelihood of smoke emissions disturbing winter roosting bats. The likelihood of smoke emissions adverse affecting any winter roosting Indiana bats is virtually non-existent since the nearest known Indiana bat hibernacula is well over ten miles away. At this distance, smoke dispersion should be such that in the event any smoke would travel in the direction of the hibernacula, smoke concentrations would be miniscule. Prescribed burning operations should pose virtually no risk to winter roosting Indiana bats.

While extending burning into early April slightly increases the risk of female bats being present within summer roost trees, the risk is considered to be minimal since young of the year will not have been born yet and the female would be mobile enough to vacate roost trees. Since the most recent research indicates that the majority of male Indiana bats do not emerge from hibernacula until after May 1, dormant season burning is unlikely to directly affect roosting male Indiana bats. Ceasing burning activities after May 1st should minimize the potential for prescribed burning operations having an adverse direct effect on both male Indiana bats and Indiana bat maternity colonies. The potential for direct effects to summer roosting Indiana bats could be virtually eliminated by restricting all burning to before April 1st.

Tree/Shrub Felling: The felling of snags, or the cutting/felling of suitable live roost trees greater than 6”dbh, has the potential to cause direct effects to summer roosting bats when conducted between April 1-September 30, since bats may using snags and live roost trees as summer roost sites. Since maternity colonies have only been documented as using trees greater than 9”dbh, the risk only exists for maternity colonies when trees greater than 9”dbh will be cut. In the event that a snag or suitable live roost tree is to be felled or girdled, it is conceivable that bats would be forced to either vacate roost tree, or remain in the tree and potentially be killed/crushed from falling trees or heavy equipment. It is likely that solitary male bats would be aroused and readily vacate the tree, being forced to select a suitable roost tree outside of the influences of the localized disturbance. For maternity colonies, the potential for directly harming summer roosting bats is greatest when young bats are non-volant (unable to fly). After young of the year are volant, the risk of killing roosting bats drops substantially. However, there is a physiological risk to bats that are aroused from semi-torpor during the summer period. Additionally, forcing roosting bats to vacate preferred summer roost trees exposes them to a greater risk of being killed during daylight hours by aerial predators.

The December 2005 USFWS BO requires that no suitable snags or live roost trees be removed from April 1 through September 30 unless an evaluation and/or surveys be conducted to determine non-use by roosting bats. Design criteria have been built into Alternative Two that stipulate that no suitable snags or live roost trees will be cut/felled from April 1 through September 30. During this time period, and only for the purposes of releasing Mead's milkweed plants, any trees needing to be "removed" will be girdled and left standing, which should remove the potential for direct mortality occurring to roosting Indiana bats. Girdling, if conducted using gas-powered chainsaws, has the potential to disturbe roosting bats resulting from noise from the operation of gas-powered equipment, and vibration to the roost tree. However, this activity will only take place in the event that any Meades Milkweed plants need to be released. Consequently, the likelihood of this having to take place is low, and the potential for directly affecting Indiana bats is also low. As a worst case scenario, this type of activity would only take place on a maximum of two acres per year. The small amount of acreage treated annually, and the low likelihood of any trees having to be girdled, suggests a very low likelihood of directing affecting any summer roosting Indiana bats.

In the event that any suitable standing live roost trees must be girdled/felled from April 1-September 30 for the purpose of releasing Mead's Milkweed plants, exit counts will be conducted to determine non-use by bats. In the event that exit counts indicate the presence of roosting bats in any tree needing girdled, girdling will only take place after September 30th.

Prescribed burning has a potential to cause direct effects to Indiana bats during both the summer and winter periods.

Burning conducted during the summer maternity period has a potential of directly harming roosting bats resulting from: smoke and other emissions, burning of the roost tree, and disturbance that causes the roosting bat(s) to vacate the roost tree. The "terms and conditions" spelled out in the USFWS December 2005 BO restricts the use of prescribed fire from May 1 through September 1. Design Criteria #3 prohibits conducting burning between May 1 and September 1, so no direct effects to Indiana bats from summer burning. Since female Indiana bats have been reported exiting winter hibernation sites in early April, the potential still exists that individual adult female Indiana bats could be directly affected by any burning that occurs between April 1 and May 1. However, no burning has taken place on the Forest for at least the past four years after about April 10th, due to spring green up, so the likelihood of burns being carried out after April 10th is extremely low.

Burning conducted between September 1 and May 1 has the potential of directly affecting winter roosting bats resulting from smoke and burning emissions entering winter roost sites. Arousal of bats from exposure to smoke in hibernacula is a concern relative to dormant-season burning. Bats arouse from hibernation periodically as a normal course of affairs, possibly because of the need to rehydrate, but each arousal is energetically equivalent to many days of hibernations, and extra arousals from smoke exposure or other causes area serious concern (Dickinson et al. 2008). At the current time, no known Indiana bat hibernacula exist within or near the four areas proposed for burning, so no winter roosting Indiana bats should be directly affected by dormant season burning.

All of the "Terms and Conditions" specified by the USFWS December 2005 BO have been incorporated as "*Design Criteria*", and will be fully implemented.

Potential Indirect Effects

Prescribed Burning: Indirect effects of fire on bats arise from fire-induced habitat change. Fire use is oftentimes advocated as a way of improving bat habitat, through snag production, creation of more open stands preferred for foraging, and increased insect abundance. Fire, alone or in combination with thinning, may affect bat roost availability. Fires both create and destroy snags (dead trees), with unknown long-term effects in eastern hardwood forests (Dickinson et al. 2008). For tree roosting bats, fire can enhance roosting habitat by creating snags and increasing solar radiation at existing roosts (Johnson et al. 2009). Fires would be expected to reduce insect prey abundances in the short-term, but their long-term effects on prey abundances are unknown (Dickinson et al. 2008).

Johnson et al. (2009) looked at roost tree selection by northern myotis (*Myotis septentrionalis*) maternity colonies following prescribed burning in a Central Appalachian mountain hardwood forest. They determined that within burned areas, northern myotis maternity colonies were more likely to use roost trees that were associated with larger canopy gaps created by the senescence and decay of the surrounding fire-killed overstory trees. Northern myotis readily exploited alterations to forest structure created by the reintroduction of fire, which accelerated snag creation and enlarged existing or created new canopy gaps.

Prescribed burning may burn up some standing snags, depending upon specific burning conditions. This could be minimized by: raking around suitable roost trees, applying foam around the base of suitable roost trees, or burning under wetter conditions such that snags are unlikely to catch fire. Dormant-season prescribed burning conducted on the Hidden Springs Ranger District over the past several years has typically taken place when fuel moisture conditions are such that few standing snags become consumed by fire. It would be virtually unpractical to rake around, or to apply foam to, every suitable Indiana bat roost tree, since live roost trees are very abundant in all four areas and the total size of the proposed burn area is quite large. Burning under wetter conditions would minimize the likelihood of snags catching fire and being consumed.

Prescribed burning operations will undoubtedly result in additional mortality to some live hardwood and pine trees, which should further increase the availability of summer roost trees within the project area. Boyles and Aubrey (2006) conducted a study in Missouri looking at the impacts to evening bats (*Nycticeius humeralis*) from prescribed burning. They found that there were a significantly higher proportion of dead trees, which evening bats commonly use as roost trees, in burned forests compared to unburned forests. They concluded: "*Prescribed burning appears to initially lead to creation or restoration of favorable cavity-dwelling bat habitat and its continual implementation perpetuates an open sub-canopy. Therefore, we suggest that prescribed burning may be a suitable tool for management of roosting habitat for cavity-roosting bats*".

It is highly likely that any snags consumed by burning conducted in the four areas will be more than offset by the creation of additional snags resulting from burning and/or girdling of trees to release TES plants, ultimately resulting in an improvement in roosting habitat conditions for cavity-roosting bats. The distribution and abundance of hardwood tree cavities should increase as the result of butt scarring from repeated burning.

The likelihood of smoke entering any Indiana bat hibernacula should be virtually non-existent, since the closest hibernacula is well over 10 miles away from any of the areas proposed for burning. Winter cave surveys, plus two years of fall harp trapping, have failed to document any Indiana bats using Equality Cave (Cave Hill Cave). It is assumed that Equality Cave is not currently being used by Indiana bats. Consequently, any smoke inadvertently enter this cave should have no adverse direct effects to winter or summer roosting Indiana bats.

If the repeated burning is successful in reducing the density of dominant canopy trees, as well as understory and mid-story shrubs, saplings, and pole timber, there should be an increase in the amount of solar radiation to snags and live roost trees. Summer maternity colonies require somewhat stable warm summer temperatures during the summer months to facilitate growth and development of young bats. Increased solar radiation to suitable roost trees should improve the suitability of summer roost trees. Implementation of Alternative Two should have beneficial indirect effects by improving the suitability of summer roost trees within the four areas.

Indiana bats oftentimes avoid areas that are dense with mid-story vegetation ("vegetative clutter") for foraging during the summer months. Reducing tree spacing and vegetative clutter should improve the quality of Indiana bat foraging habitat within the four areas. The creation of small forest openings may also have positive indirect habitat benefits by providing bat foraging areas (Grindal and Brigham 1998). Implementation of Alternative Two should have positive indirect effects by improving the quality of foraging habitat within the four areas.

The USFWS is concerned about the total amount of forested area surrounding hibernacula that is blackened at any one time during any year due to potential reductions in Indiana bat primary prey species. To avoid this from occurring, the USFWS BO established limits on the maximum percentage of Forest Service land that can be blackened in any one year within 2.5 mile and 5.0 mile radii surrounding known Indiana bat hibernacula. However, no known Indiana bat hibernacula exist within a five mile radius of any of the four areas. Consequently, this standard does not apply to this project. The likelihood of smoke generated by prescribed burning carried away from the four areas is extremely low of every reaching the closest Indiana bat hibernacula over ten miles away.

The effects determination for the implementation of this project is "*may affect-not likely to adversely affect*" Indiana bat populations on the Forest. Implementation of Forest Plan standards and guidelines, and full compliance with USFWS BO "*Terms and Conditions*" eliminates the potential for direct adverse effects to occur. Implementation of tree/shrub felling is expected to have no negative long-term or cumulative adverse effects on the Indiana bat or to Indiana bat habitat, due to the small amount of habitat involved and the short duration of the project.

Because there are no other federally proposed or listed animal species habitat present within the affected project activity areas, implementation of this proposed project will have "no direct, indirect or cumulative adverse effects" on any other federally listed animal species. Consequently, no additional consultation with the US Fish and Wildlife Service is required. In the case of new information, the Forest Service will initiate informal consultation with the US Fish and Wildlife Service.

Direct, Indirect and Cumulative Impacts to Region Nine Sensitive Species

Eastern Timber Rattlesnake

Alternative One:

Alternative One is not expected to have any direct or indirect adverse impacts to this species. Maintenance of the existing roads as open to public motorized vehicles maintains the current risk of snakes coming into contact with humans and motorized vehicles. With no direct or indirect adverse impacts, there should be no cumulative adverse impacts. Timber rattlesnake habitat quality should remain somewhat constant over time.

Alternative Two:

Implementation of prescribed burning and tree/shrub felling may have both direct and indirect impacts to timber rattlesnakes in the following way: 1) individual snakes could be killed (while in hibernation as well as after emergence from hibernation) from the direct impacts of flame/smoke/heat; and, 2) rattlesnake foraging habitat could be improved, and subsequent increase in prey species numbers, from the indirect impacts from the opening up of the canopy, creation of small canopy openings, and/or maintenance of existing abandoned wildlife openings as foraging habitat.

Potential Direct Impacts

Prescribed Burning: Prescribed burning has the potential to cause mortality to rattlesnakes, if conducted during late spring, summer, or early fall months, since rattlesnakes would be more likely to be present within proposed burn areas. However, all prescribed burning will be conducted after September 31 and before May 1, which should reduce the likelihood of rattlesnakes being present during burning operations. However, the potential exists that rattlesnakes might be present within burned areas in April and October, especially if late spring/early winter weather conditions are warmer than usual. Consequently, the risk exists that individual snakes could be directly affected by burning operations that are conducted during between April 1 and May 1. This potential effect could be avoided by burning earlier in the spring (before April 1st) and later in the fall (after October 31st).

Over the last several years, little to no prescribed burning has taken place on the Hidden Springs RD before November 1st, and this is not anticipated to change. Likewise, typically no burning has taken place after around April 10th. Again, this is not expected to change since spring green-up usually commences in early April. Thus, the only time period that poses a risk of individual

rattlesnakes being directly affected by burning is a very short time period (one to two weeks) in late winter/early spring. Burning conducted during this time period could have direct adverse effects to individual rattlesnakes. For the majority of the dormant-season burning period, rattlesnakes should be absent from burn areas (i.e. hibernating in winter den sites) and thus relatively unaffected by prescribed burning activities.

While it is feasible that implementation of Alternative Two could result in direct mortality to an individual rattlesnake that might be present within the project area incurred from the effects of burning, the likelihood of this action occurring is minimized by the fact that the burning will be conducted when a high percentage of snakes should still be in winter hibernation and absent from the affected area.

Additionally, it is anticipated an abundance of unburned areas will be well distributed throughout the burn areas, since typically dormant season burns result in a mosaic of burned and unburned areas. These islands of unburned fuel should provide adequate areas for snakes to retreat to avoid the oncoming flames, heat, and smoke. In addition, there should be a suitable distribution of other refugia sites (i.e. root holes, downed logs, rock crevices, boulder fields, etc.) where snakes can secure suitable refuge to avoid the direct effects of oncoming flames. While the possibility exists that an individual rattlesnake could be killed from burning, this effect should not be of such a magnitude such as to cause an adverse impacts to population viability across the Forest.

Suitable denning habitat is scattered throughout portions of all four areas in the form of rock outcrops, cliff-lines, rock shelters, and boulder fields. There is a risk of direct mortality occurring to hibernating rattlesnakes resulting from prescribed fire. However, the risk of burning directly affecting hibernating rattlesnakes is considered to be low, since snakes should be far enough removed in rocky areas so as to be insulated from any approaching flame, heat or other adverse effects. Implementation of Alternative Two is not expected to have any direct or indirect adverse impacts on rattlesnake denning habitat.

Potential Indirect Impacts

Prescribed Burning: Frequent burning may alter the type of arrangement of suitable or unsuitable timber rattlesnake habitat within the affected project areas. While fairly frequent burning may reduce the amount of small downed logs on the forest floor, the frequent burning, over time, should result in tree mortality and subsequent increase in the availability of large downed woody debris. This should improve habitat for rattlesnake prey species, and increase the amount of refugia scattered throughout the four areas.

If burning achieves the intended objectives, over time, there should be a reduction in tree canopy density, a reduction in the number of shrubs/saplings/pole timber in the mid and understory, and an increase in the diversity and abundance of herbaceous vegetation on the forest floor. This should support greater numbers of prey species. The existing abandoned wildlife openings should have fewer shrubs and saplings, with a greater diversity and abundance of herbaceous plants, thus supporting a greater diversity and abundance of rattlesnake prey species. Should these changes occur over the four areas, Implementation of Alternative Two should have a

positive indirect effect on timber rattlesnake habitat. The creation of a herbaceous ground cover should improve habitat for prey species, which would improve rattlesnake foraging habitat. Repeated burning may retain for a longer period of time the suitability of the scattered abandoned wildlife openings to serve as prey species habitat, both in the short-term as well as in the long-term. At the present time, early successional habitat is somewhat limited within the four areas. An improvement in foraging habitat should result in increased rattlesnake numbers throughout the four areas. Alternative Two would be expected to result in improved rattlesnake habitat quality in both the short-term as well as the long-term.

Access Roads: The presence of access roads for motorized vehicles and/or trails within habitat occupied by timber rattlesnakes increases the likelihood of snake and human interactions. As timber rattlesnakes forage throughout their home range, the higher the number of roads open to unrestricted public motorized vehicle access the higher the likelihood that snakes will come in contact with people and motorized vehicles resulting in death to snakes. The greater the number and/or density of recreation trails and higher recreational use the greater the likelihood of snake/people interactions and the higher likelihood of mortality occurring to rattlesnakes. Since no new roads or trails are proposed as part of this project, mortality rates incurred from interactions with humans recreating in the four areas, or across the Forest, should remain at levels comparable to current rates.

Implementation of Alternative Two should have no cumulative adverse impacts to timber rattlesnake populations or habitat due to the low level and type of activity proposed for the project area, as well as past, present, and reasonably foreseeable future activities that modify rattlesnake habitat on non-National Forest and National Forest lands. Timber rattlesnake habitat should be improved in the project area in the long term, potentially benefiting rattlesnake populations on the Forest. Implementation of Alternative Two has the potential to impact individuals, but should have no adverse impact on population viability across the Forest.

Southeastern Myotis

Conducting prescribed burning, and the felling of trees and shrubs has the potential to have both direct and indirect impacts on southeastern myotis. Suitable live summer roost trees could be destroyed during fall/winter burning, resulting in fewer roost trees available. Smoke could enter hibernacula, causing disturbance to roosting bats, and potentially increase winter mortality rates. One cave is present in the Cave Hill area that provides conditions suitable for use by *southeastern myotis both during the summer and winter months.* The Forest is committed to continue to provide conditions within, and surrounding, Equality Cave so as to maintain Equality Cave as a suitable hibernation site for southeastern myotis.

<u>Alternative One:</u>

Implementation of Alternative One will maintain existing foraging and roosting habitat conditions throughout the four areas. The risk of smoke generated from prescribed burning entering Equality Cave is non-existent. There will be no improvement in the quantity, quality, or

distribution of summer roosting habitat. There will be no improvement in foraging or summer roosting habitat.

This alternative should have no direct or indirect adverse impacts to southeastern myotis populations or habitat. Since there will be no direct or indirect impacts, there should be no cumulative adverse impacts.

Alternative Two:

Equality Cave (Cave Hill Cave) is known to harbor both a summer roosting bachelor colony, as well as winter roosting bats. Since prescribe burning will only take place during the dormant season (October-April), there is no risk to summer roosting bats. Consequently, Implementation of Alternative Two could affect southeastern myotis in the following way: 1) smoke could enter the cave while winter roosting bats are roosting in the cave during prescribe burning activities, potentially causing forcing bats to vacate the cave, and causing increased winter mortality; 2) the availability of suitable summer roost trees could be altered; and/or 3) the quality of summer foraging habitat could be altered.

Potential Direct Impacts

Prescribed Burning: Prescribed burning has the potential to cause smoke and other particulate matter to enter the cave while bats are hibernating or in torpor. Arousal of bats from exposure to smoke in hibernacula is a concern relative to dormant-season burning conducted between October 1 and April 30. Bats arouse from hibernation periodically as a normal course of affairs, possibly because of the need to rehydrate, but each arousal is energetically equivalent to many days of hibernations, and extra arousals from smoke exposure or other causes area serious concern (Dickinson et al. 2008). Southeastern myotis are known to enter and exit winter torpor to feed with greater regularity than other bats, so the overall impacts of this action may be less than for other *Myotis* spp.

M. austroriparius, like most other cave-dwelling bats, is particularly sensitive to disturbance in hibernacula (Amelon et al. 2006). Any activity that results in the disturbance to winter roosting bats could adversely affect bats by causing bats to become aroused too frequently, which could lead to a premature depletion of winter fat reserves, ultimately causing starvation and death. The introduction of smoke generated from prescribe burning could cause such an adverse disturbance. However, if smoke would enter into the cave later in the winter/early spring months, in conjunction with warm weather such that flying insects have emerged, disturbed bats could replenish fat reserves by foraging during suitable nights, which would minimize the magnitude of the effects from this disturbance.

Implementation of Design Criteria #4 should reduce the likelihood, to the extent practicable, of smoke generated from prescribed burning entering Equality Cave.

Tree/Shrub Felling: The felling of suitable summer roost trees has the potential for directly impacting roosting bats, potentially causing mortality. The likelihood of this action occurring within the affected project areas is minimized by these factors: 1) southeastern myotis typically

select summer roost trees in riverine floodplain areas, and none of this type of habitat will be affected by burning; 2) no suitable dead or live summer roost trees will be felled from April 1 through September 30 (Design Criteria #1 and #2); and, 3) a very small amount of habitat (less than 2 acres total) potentially may be involved each year.

Prime summer foraging habitat is reported to be wetlands, riparian, and/or bottomland hardwood forest. No wetland or bottomland habitat is present within the four areas, so no prime summer foraging habitat will be directly affected by implementation of Alternative Two. It is possible that *M. austroriparius* could use portions of the affected project area as summer foraging habitat.

It is feasible that this species may utilize more upland habitats present within the Cave Hill, Dennison Hollow, or Stoneface Areas for foraging. It is unlikely that *M. austroriparius* would be using Simpson Barrens, since there are no known records of this species in close proximity to the Simpson area.

Potential Indirect Impacts

Prescribed Burning: Implementation of Alternative Two could result in positive indirect benefits to southeastern myotis summer foraging habitat. This would be accomplished as re-occurring fire reduces the density of the mid and upper canopy, thus allowing a greater degree of solar radiation to reach the forest floor, establishment of a more lush herbaceous vegetative strata on the forest floor, and increased insect numbers.

Tree/Shrub Felling: Additional improvements to summer foraging habitat may result from the creation of small canopy gaps (Grindal and Brigham 1998). However, any potential improvements from this activity is expected to be very small, since such a very minor amount of habitat will be involved. Riverine, wetland, and bottomland hardwood has been reported to represent the most highly suitable habitat for summer roosting sites, using hollow trees. None of this habitat type is available in any of the four areas proposed for restoration. Alternative Two is not expected to have any direct impacts to this species from shrub/tree felling/removal/girdling since no suitable summer roost trees will be felled/removed from April 1 through September 30.

Implementation of Alternative Two is projected to have positive indirect impacts to southeastern myotis summer foraging habitat. With full implementation of measures to prevent the introduction of fire emissions to Equality Cave, there should be no direct adverse impacts from the implementation of Alternative Two.

Eastern Small-footed Bat

While there are no EOR's for the project area, suitable habitat is present, and the species is known to occur at Fink Sandstone Barrens, which is located several miles from the project area. This EOR is the only record of this species in Illinois. Illinois is located at the extreme edge of its range. Given the low known occurrence of this species in Illinois, it is unlikely that this species is present within any of the four areas. Additionally, recent bat surveys conducted in Equality Cave have failed to document the presence of this species.

Alternative One:

Implementation of Alternative One should have no direct or indirect impacts to *M. leibii,* since no management action would take place. Since there will be no direct or indirect impacts, there should be no cumulative adverse impacts.

Alternative Two:

Implementation of prescribed burning has the potential to have both direct and indirect impacts to *Myotis leibii* populations and habitat.

Potential Direct Impacts

Implementation of Alternative Two has the possibility of causing direct impacts to eastern small-footed bats in the following ways: 1) bats roosting within rocky formations (caves, rock crevices, rock shelters, boulder fields, etc.) during prescribed burns could be directly impacted by smoke, disturbance, and/or flames; and, 2) summer roosting bats could be directly impacted by the felling of trees.

Prescribed Burning: It is possible that eastern small-footed bats could be present roosting in rock crevices, under rocks or within boulder fields, or in Equality Cave, when prescribed burning activities would be carried out. It is unlikely that bats would be directly harmed, since it is unlikely that any bats would come in direct contact with flames.

Several factors have the potential to minimize the likelihood that *M. leibii* would be directly impacted by prescribed burning. Since *M. leibii* has been found to be one of the last to enter hibernacula, seldom entering before mid-November and often departing by early March, it is feasible that any bats roosting in crevices would have already exited from hibernation sites prior to the time that dormant season prescribed burning would take place. Additionally, researchers have documented periods of activity during hibernation suggesting *M. leibii* may not spend as much time in deep torpor as do other cave-hibernating species (Amelon and Burhans 2006). Consequently, any potential disturbance to any roosting bats present during the time when burning is conducted is likely to be very minimal.

The likelihood of smoke generated from burning entering Equality Cave should be minimal, since burning will only be conducted under the appropriate burning conditions (i.e. prevailing wind) and with a “no-burn” buffer zone established around Equality Cave. Consequently, it is unlikely that implementation of prescribed burning activities will have any direct adverse impacts to individual bats.

Tree/Shrub Felling: The potential exists for summer roosting bats to be directly impacted by the felling of summer roost trees occupied by eastern small-footed bats. The likelihood of this taking place is minimized, to the extent practicable, by implementation of Design Criteria #1 and #2.

Potential Indirect Impacts

Prescribed Burning: Based on the most current literature, it is likely that the density of the tree canopy, and mid and understory shrubs-trees, will be reduced, thus creating a more diverse forest floor flora. This should result in an improvement in foraging habitat quality for *M. leibii*, due to increased insect production. Grindal and Brigham (1998) reported that small forest openings may offer opportunities for bats to forage. Some smaller-diameter snags could catch fire during burning and fall to the ground. However, this loss should be more than offset by a projected increase in snags created by tree mortality associated from burning.

Implementation of burning is expected to have positive indirect habitat benefits by improving foraging habitat, and the creation of additional snags and cavity trees.

Tree/Shrub Felling: The creation of small canopy gaps would be expected to create small forest openings within a somewhat densely canopied forest. The establishment of these small canopy gaps should create additional foraging sites for small-footed bats.

While the likelihood is extremely low that eastern small-footed bats would be present within the four project areas during burning, the potential exists that individual eastern small-footed bats may be impacted. However, these impacts should not escalate to a level whereas population viability is adversely impacted across the Forest.

Rafinesque's big-eared Bat

<u>Alternative One:</u>

Implementation of Alternative One should have no direct or indirect impacts to *C. rafinesquii* populations or habitat since no activities will be undertaken that have the potential to adversely impact bats or habitat. Since there will be no direct or indirect adverse impacts, there should be no cumulative impacts.

<u>Alternative Two:</u>

The species is not known from any of the four areas proposed for burning. All of the records for this species in Johnson County have been summer records and associated with man-made dwellings (i.e. houses/barns). No man-made dwellings are located within the four areas proposed for restoration work. Thus, the likelihood of *C. rafinesquii* being present within any of the proposed affected project areas is less.

Rafinesque's big-eared bats are also known to also use rock shelters, cliff-line habitats, and caves for roosting. This habitat is present throughout portions of the affected project areas. Rafinesque's big-eared bats could be impacted from burning if individuals are present within these rocky habitat features during burning.

Equality Cave offers suitable summer and winter roosting habitat, and is the only known cave within the four areas proposed for burning. However, bat surveys (i.e cave surveys and fall swarming surveys) conducted of Equality Cave in 2006, 2007, 2008, and 2009 have failed to

document the presence of *C. rafinesquii*. At the present time, *R. rafinesquii* is not considered to be present in Equality Cave.

Potential Direct Impacts

Prescribed Burning: The species could be present within the four areas during summer months, roosting (daytime and/or night-time feeding roosts) in rock shelters and/or hollow trees, or foraging. In Alternative Two, no burning will be conducted during this time of year (May 1-September 1), which should effectively eliminate the possibility of this species being directly impacted by smoke during summer months. No big-eared bats are known to be using Equality Cave, and no other caves are known to be present within the four affected project areas that are used by big-eared bats. No occurrence records exist within the four affected project areas. It is unlikely that big-eared bats would be present within rock shelter or cliff-line habitats during the time when prescribed burning would be carried out.

Tree/Shrub Felling: The felling of standing dead or live trees that have cavities has the potential to directly impact any big-eared bats that might be roosting in those trees, which could result in direct mortality to roosting bats. Under Alternative Two, no suitable roost trees occupied by bats will be felled/removed from April 1-September 30, which should effectively eliminate the possibility of this species being directly impacted by slashing/felling/girdling of trees during summer months

Potential Indirect Impacts

Prescribed Burning: Prescribed burning may have immediate short-term negative indirect impacts in reducing the number of hollow trees as these trees are consumed by fire. However, in the long-term burning should have beneficial indirect impacts by improving summer roosting habitat through the creation of additional hollow tree cavities and snags resulting from fire-associated mortality. Burning should have beneficial short-term and long-term impacts on *C. rafinesquii* foraging habitat as fire reduces canopy density, and increases the diversity and density of the forest floor flora. Grindal and Brigham (1998) reported that small forest openings may offer opportunities for bats to forage. Over time, repeated burning is likely to reduce the density of understory trees and shrubs, which should reduce stand density, thus improving the quality of foraging habitat due to less vegetative clutter.

Tree/Shrub Felling: As more forest openings are created by the creation of small forest gaps from tree/shrub felling, additional open foraging habitat should be created, which will improve the quantity and quantity of summer foraging habitat.

For the aforementioned reasons, implementation of Alternative Two is not likely to have any adverse direct or indirect impacts on *C. rafinesquii* populations or habitat.

Mitigation

The Forest Plan contains standards and guidelines to protect habitat, to sustain species diversity, to conserve biological diversity, and to ensure the sustaining of populations for the majority of

the federal listed and proposed, as well as regional nine sensitive, species known or likely to occur on lands within the administrative boundary for the Shawnee National Forest. These standard and guidelines would apply when and where needed during various stages of project implementation. These standards and guidelines were reviewed by the US Fish and Wildlife Service during formal consultation for the Amended Forest Plan. In the event any new information is derived that would indicate the presence of other federally listed or region nine sensitive species within the project activity area, project activities would be temporarily suspended, the information would be analyzed, and a determination rendered for any additional project stipulations or mitigation deemed necessary to protect species viability across the Forest.

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Rod D. McClanahan, Wildlife Biologist Date

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