United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, Virginia 23061

January 13, 2004

Mr. Robert T. Jacobs
Regional Forester
U.S. Forest Service
1720 Peachtree Road NW
Atlanta, Georgia 30309

Re: 2003 Revised Jefferson National Forest Land and Resource Management Plan, Virginia, West Virginia, Kentucky

Dear Mr. Jacobs:

This document transmits the U.S. Fish and Wildlife Service's (FWS) biological opinion based on our review of the 2003 Revised Jefferson National Forest Land and Resource Management Plan (JLRMP) and its effects on federally endangered and threatened species and their critical habitats. The planning area covers approximately 723,300 acres and is located in 19 Virginia counties (Bedford, Bland, Botetourt, Carroll, Craig, Dickenson, Giles, Grayson, Lee, Montgomery, Pulaski, Roanoke, Rockbridge, Scott, Smyth, Tazewell, Washington, Wise, and Wythe); Monroe County, West Virginia; and Letcher and Pike Counties, Kentucky. This biological opinion is submitted in accordance with Section 7 of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). The U.S. Forest Service's (FS) August 18, 2003 request for formal consultation was received on August 19, 2003.

This biological opinion is based on information provided in the FS's August 2003 programmatic biological assessment, the February 2003 JLRMP and Environmental Impact Statement, telephone conversations with FS biologists, joint FWS-FS meetings and field investigations, and other sources of information. A complete administrative record of this consultation is on file in the Southwestern Virginia Field Office, 330 Cummings Street, Abingdon, VA 24210; telephone (276) 623-1233.

The FWS concurs with your Biological Assessment (BA) that the Revised JLRMP provides broad goals, objectives, standards and guidelines with respect to meeting the needs of the federally listed species and critical habitat evaluated in your BA. The FWS concurs with your findings that activities described in the JLRMP will have no effect on the gray bat (*Myotis grisescens*), bald eagle (*Haliaeetus leucocephalus*), Virginia round-leaf birch (*Betula uber*), and

Peter's Mountain-mallow (*Iliamna corei*). The FWS believes that the proposed actions under the JLRMP are not likely to adversely affect the following species and their critical habitats due to the Forest Service's proposed management actions to protect these species, and the fact that any specific actions that may affect these species will undergo separate consultation between the FS and the FWS.

Mammals and Birds: Virginia big-eared bat (*Corynorhinus townsendii virginica*), Carolina northern flying squirrel (*Glaucomys sabrinus coloratus*).

Fishes: Spotfin chub (*Cyprinella monacha*), slender chub (*Erimystax cahni*), duskytail darter (*Etheostoma percnurum*), yellowfin madtom (*Noturus flavipinnis*), Roanoke logperch (*Percina rex*), blackside dace (*Phoxinus cumberlandensis*).

Mollusks: Fanshell (*Cyprogenia stegaria*), dromedary pearlymussel (*Dromus dromas*), Cumberland combshell (*Epioblasma brevidens*), oyster mussel (*Epioblasma capsaeformis*), tan riffleshell (*Epioblasma florentina walkeri*), green-blossom pearlymussel (*Epioblasma torulosa gubernaculums*), shiny pigtoe (*Fusconaia cor*), fine-rayed pigtoe (*Fusconaia cuneolus*), cracking pearlymussel (*Hemistena lata*), pink mucket pearlymussel (*Lampsilis abrupta*), birdwing pearlymussel (*Lemiox rimosus*), little-winged pearlymussel (*Pegias fibula*), James spinymussel (*Pleurobema collina*), rough pigtoe (*Pleurobema plenum*), rough rabbitsfoot (*Quadrula cylindrica strigillata*), Cumberland monkeyface (*Quadrula intermedia*), Appalachian monkeyface (*Quadrula sparsa*), purple bean (*Villosa perpurpurea*), Cumberland bean (*Villosa trabilis*).

Plants: Small whorled pogonia (*Isotria medeoloides*), northeastern bulrush (*Scirpus ancistrochaetus*), Virginia spiraea (*Spiraea virginiana*).

The FWS believes the Revised JLRMP's riparian standards are a significant improvement from previous JLRMP standards and are sufficient in maintaining riparian function for the protection of federally listed aquatic species. The FWS recognizes the importance of riparian areas associated with intermittent and ephemeral streams as well as perennial streams in protecting and maintaining riparian habitats and water quality. We applaud the FS's adoption of protective standards that extend beyond perennial streams to include intermittent and ephemeral streams. However, we consider the core buffer widths outlined in the Revised JLRMP riparian standards to be the minimum widths necessary to protect the aforementioned federally listed aquatic species. Consequently, standards may need to be adjusted at the project level to ensure additional protection. The forest-wide riparian standards outlined in the Revised JLRMP require a 100 foot (ft.) and 50 ft. riparian core protection area on each side of perennial and intermittent streams, respectively. While the revised riparian standards offer considerable habitat benefits to many species, protecting diverse terrestrial riparian wildlife communities generally requires stream-side buffers of 300 ft. or greater (Wenger 1999). Given that more detailed planning will be required at the project level, the FWS stresses the need for our continued involvement as part of an interdisciplinary team that will ensure adequate protective measures for aquatic listed species and critical habitat.

The remainder of this biological opinion applies to the FS's determination that the revised JLRMP is likely to adversely affect the Indiana bat (*Myotis sodalis*). Much of the information used in this biological opinion has been taken from the FS's 2003 Biological Assessment.

Consultation History

Significant events related to this consultation, including actions taken prior to formal consultation, are listed chronologically in Appendix A.

The FS completed a previous Biological Assessment in April 1997 to analyze effects to the Indiana bat resulting from continued implementation of the George Washington and Jefferson National Forest Plans. The FS requested formal consultation with the U.S. Fish and Wildlife Service on May 12, 1997. The FWS issued a Biological Opinion on September 16, 1997, which included incidental take provisions along with Terms and Conditions and Conservation Recommendations. The 1985 Jefferson Forest Plan (along with the 1993 George Washington Forest Plan) was amended to include provisions resulting from that formal consultation. Information presented in the 1997 Biological Assessment and Biological Opinion is still pertinent to the 2003 Revised JLRMP, Final Environmental Impact Statement for the JLRMP (2003), and the 2003 Biological Assessment and is therefore incorporated by reference. The 2003 Biological Assessment includes new information resulting from observations and studies since 1997.

BIOLOGICAL OPINION

I. DESCRIPTION OF PROPOSED ACTION

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

The FWS has determined the action area for this project includes the entire Jefferson National Forest (JNF) since the FS will conduct activities throughout the JNF. The JNF consists of approximately 723,300 acres, of which 716,400 acres are forested and 6,900 are non-forested including water bodies. The JNF is located in 19 Virginia counties (703,300 acres), one West Virginia county (19,000 acres), and two Kentucky counties (1,000 acres). The JNF is subdivided into the Mount Rogers National Recreation Area and four Ranger Districts: Clinch, Glenwood, New Castle, and New River Valley.

Proposed Actions

This biological opinion addresses a variety of land management directions and associated activities that are planned, funded, executed, or permitted by the JNF. The original JLRMP was issued October 1985. The 2003 Revised JLRMP is a general programmatic planning document that provides management goals, objectives, and standards under which project level activities (e.g., timber sales, wildlife habitat management, road construction, special uses, etc.) may be

planned and implemented to carry out management direction of the JNF. Land use allocations are made and outputs projected based upon direction established in the Revised JLRMP. All project level activities undergo National Environmental Policy Act (NEPA) review by appropriate Forest Service personnel when proposed, as well as assessment of project effects to federally listed species in compliance with Section 7 of the ESA. The Revised JLRMP establishes multiple use management area prescriptions (including associated standards and guidelines) for future decision making, which are adjustable (via monitoring and evaluation) through amendment and/or revision.

Specific proposed activities include regeneration timber sales, salvage and firewood sales, routine creation/maintenance of small clearings, road construction/reconstruction, utility corridor construction, and herbicide applications. Other activities include, but are not limited to, the felling of occasional trees for fish structures, removal of hazard trees in developed recreational areas (campgrounds and picnic sites) and along roads, special use applications that require the clearing of small acreages, fireline construction for prescribed burns plus implementation of those burns, and creation of brush piles for small game species.

Timber sales, which include both regeneration cuts and salvage and firewood sales, are one of the primary management activities that alter and/or disturb the greatest acreage of forested habitat on the JNF. Currently, the predominant regeneration method is modified shelterwood, which typically results in a residual basal area of 20-50 square feet/acre remaining in the harvest unit. Approximately 75% of the stand is harvested, thereby leaving a partial canopy to soften the visual appearance and provide for wildlife habitat while allowing enough sunlight to provide for the growth of a new forest. The total projected annual regeneration harvests include modified shelterwood (1300 acres or 71% of total acres harvested), thinning (40 acres or 2.1% of total), group selection (40 acres or 2.1% of total), and clearcutting (450 acres or 2.4% of total). Timber sales are offered through a competitive bid process to achieve various objectives, which include stand regeneration for wildlife habitat improvement and commodity production in support of local economies. The projected annual regeneration harvests (by forest community type) are as follows: oak-hickory (1,131 acres, 72% of total), mixed pine-hardwood (165 acres, 11%), cove hardwoods (176 acres, 11%), white pine-hemlock (93 acres, 6%), and southern yellow pine (1 acre, <1%). The total average annual harvest of potentially suitable habitat for the Indiana bat (hardwood and hardwood-pine types) is projected to be 1,472 acres, which makes up approximately 94% of the total annual harvest. This acreage constitutes 0.2 % of the Forest's total land base. Over the past three years, the average annual timber harvest of hardwood and mixed hardwood-pine stands on the JNF has been 451 acres/year, with an average harvest unit size of 15-20 acres. The trend of harvested acres per year over the past three years has been one of decline from 1,115 acres in 2000 to 226 acres in 2003. Over the next ten years, the projected timber harvest trend (excluding salvage and personal use firewood) on the JNF is expected to be approximately 1,830 acres per year containing a mix of all diameter hardwood trees.

Projected personal use firewood and salvage sales (approximately 7% of total timber harvests) have two primary objectives. The first objective is to make dead trees along Forest Service roads available for personal firewood uses. Occasionally, some local operators purchase this wood for commercial use. These sales take place in designated areas on each Ranger District's closed timber sale units, and along Forest Developed Roads (FDRs). Firewood sales occur throughout the year, but occur primarily in the fall and winter. Approximately 466 fuelwood permits were

sold on the JNF in fiscal year 2002 (Federal fiscal year is October 1 – September 30). Firewood cutting is done on an individual tree basis and thus it is impossible to assign an "acres treated per year" figure to this activity. Each permit allows the individual purchaser to cut 3 cords of wood (a cord = 128 cubic feet of wood).

The second objective is to salvage trees for use as wood products following natural disasters such as wind storms, tornados, heavy snow/ice, and floods or insect outbreaks (e.g. gypsy moth, southern pine beetle). Although salvage sales are similar to other timber sales, they differ by being implemented quickly to recover dead or damaged trees for forest products (before they decay or become unsuitable for such commercial use). Between 1998 and 2003, 190 acres were cut as salvage on the JNF, which equates to approximately 38 acres/year.

It is impossible to accurately project future amounts of salvage. Potential salvage depends on the amount and severity of future tree mortality and damage resulting from events such as insect outbreaks, ice storms, and windstorms. Between 1988 and 2003, 2,672 acres were salvaged with annual amounts ranging from 0 to 766 acres per year and an average annual amount of 178 acres. Between 1998 and 2003, 245 acres were salvaged with an average of 49 acres each year. Therefore, the future projected amounts of salvage may range from 0-500 acres per year. Approximately 80% of these acres will be in hardwood (oak) forest types with the remaining 20% in pine types.

In general, road management for the JNF entails the maintenance or improvement of existing corridors (reconstruction) rather than establishing new roadways (construction). Under the Revised JLRMP, an estimated 0.5 miles/year (40 ft. wide) of new system roads are projected to be constructed. The total estimated loss of hardwood and hardwood/pine communities as a result of new system roads is approximately 2.4 acres/year. However, an estimated 1.5 to 2 miles of road are projected to be decommissioned annually as a result of the roadless area initiative. Currently, the JNF manages 1,198 miles of National Forest System Roads.

The JNF utilizes herbicides to accomplish several objectives including timber stand improvement, wildlife stand improvement, exotic plant control, endangered, threatened and rare species recovery, rare community restoration, and control of roadside vegetation. Treatment application methods include streamline bark treatment (basal stem), individual stem injection using the hack and squirt method (cut method), and chainsaw slash-down and stump spray (cut surface) using appropriate mitigation measures. The herbicides used, namely imazapyr (Arsenal, Chopper), glyphosate (Rodeo, Accord, Roundup), triclopyr amine (Garlon 3A and Garlon 4), have been evaluated and approved in the FS's Region 8 Final EIS, Vegetation Management in the Appalachian Mountains (1989).

Pest insect management (e.g., gypsy moth, southern pine beetle) was not considered as a proposed action in this opinion. If the JNF deems it necessary to initiate gypsy moth or other pest insect control in the future, a separate consultation with FWS will be necessary.

Additional acreages of trees cleared annually on the JNF potentially affecting Indiana bat summer habitat occur during routine maintenance or creation of small openings (approximately 2% of the total timber harvest). The objectives include maintaining and maximizing the benefits of linear openings to game wildlife species, maintaining safe public access within the Forest,

minimizing damage to power transmission and other utility lines, and allowing reasonable use and access to private lands within the Forest's proclamation boundary. Proposed actions include cutting of encroaching woody vegetation to provide openings for cool or warm season grasses for wildlife; removing hazard trees for road right-of-way and powerline/utility corridor right-of-way maintenance; removing hazard trees and expanding existing recreational areas (such as horse staging areas) and trail construction for recreation/trail maintenance; permitting clearing of proposed utility and communication line easements for private inholdings; and permitting the clearing of proposed private road/driveway easements, which allows the reasonable use of private lands within the Forest's proclamation boundary. Approximately 12 right-of-way/easement clearings are permitted Forest-wide per year. Because total acreages are highly variable, the best available estimate is a total of 12 projects per year at approximately 2 acres/project (24 acres/year). Recreational area expansion and trail construction is estimated at 18 acres/year.

Between 1998 and 2003, the JNF burned approximately 2,500 acres per year under prescribed conditions, primarily during the winter and spring months, for ecosystem restoration, wildlife and rare species management, site preparation, and oak/pine regeneration. An increase in the prescribed burn program is planned and is estimated to increase to 11,500 to 15,000 acres per year. The majority of these burns will occur during the spring and early summer. Additional late winter or early fall burns may also occur. Control lines will generally consist of existing roads, trails, and streams wherever possible. In areas where control lines need to be constructed, methods will include use of hand tools and/or bulldozer. Lines will consist of 2-5 foot wide strips dug to mineral soil and may amount to 9.5 to 10 acres/year over the next 10 years. Some smaller trees (9" diameter at breast height [dbh] or less) will be felled during construction, but larger trees will usually be avoided with the line going around and between them. Snags (standing dead trees) near the line will be felled which pose a hazard to personnel or may burn and fall thus spreading fire across the line into areas not scheduled for burning.

Existing Forest Service Standards and Guidelines that Provide Protection of the Indiana Bat

Standards and guidelines within the 1985 JLRMP, as amended in 1997, provided a significant level of protection for Indiana bat hibernacula (caves in which the bats spend the winter) and habitat. These standards and guidelines provide for a significant number of secure summer and fall foraging areas, and a steady supply of potential roost trees across the JNF. In addition, protection is afforded to known Indiana bat hibernacula through cave protection standards. These standards and guidelines were developed with the best information available at the time the JLRMP was amended in 1997 and remain appropriate for the management for the Indiana bat on the JNF.

For example, the potential for Indiana bats to be disturbed during hibernation on the JNF has been greatly reduced or entirely eliminated with cave gating projects now completed for both known hibernacula (Kelly Cave, Wise County, Clinch Ranger District and Shires Cave, Craig County, New Castle Ranger District), occurring on the JNF. These two caves were prioritized for gating based on the degree of human disturbance and recent Indiana bat usage. Biologists also conduct surveys of these hibernating populations every two years to determine if the populations are stable, increasing, or declining. If additional hibernacula are found, the JNF will gate those caves, if necessary, to protect Indiana bats during the critical hibernation period.

The standards and guidelines in the 1997 amendment to the JLRMP also provided direction for maintaining snags and potential "den" or "wildlife" trees in areas that are influenced by timber regeneration cuts. Standards developed to provide hard mast will also result in maintenance of the oak and hickory tree species typically utilized as roosts by Indiana bats. Riparian area standards for streams, lakes, and ponds protect potential drinking water sources for the Indiana bat while maintaining some overstory cover for protection from avian predators while foraging.

Conservation Measures Provided in the 2003 Revised JLRMP

At the time the 1985 JLRMP was written, land management directions were based upon the most up to date information available (UWFWS 1983) for the management of the Indiana bat and its habitat on the JNF. Both the JNF and George Washington National Forest (GWNF) were then known to harbor several small Indiana bat hibernacula, and the Forest Plans emphasized the protection of these cave sites. Measures specifically designed to protect, maintain, or enhance summer habitat or prevent impacts to Indiana bats roosting in trees were not identified in either of the two former LRMPs because there were no documented summer occurrence records at the time of the LRMPs' implementation. Since then, summer occurrences of this species have been documented. Five adult males and one immature male were captured in western Virginia during the summer of 1992 (Hobson 1993). A single male Indiana bat was observed (via radio telemetry) utilizing a mature live shagbark hickory for roosting in April-May of 1993 within the GWNF (Warm Springs Ranger District, Bath County) (Hobson and Holland 1995). Consequently, GWJNF biologists (in coordination with the Virginia Department of Game and Inland Fisheries (VDGIF), Ferrum College and the FWS), developed an Indiana Bat Recovery Strategy (IBRS) for the two National Forests (USFS 1997), which was intended to manage for Indiana bats on the National Forests in a manner that would help reverse the population decline that has occurred, and reestablish a healthy population that would help contribute to the down-listing (changing the status from endangered to threatened) and eventual delisting (removal of the Indiana bat from the endangered species list).

Management direction and activities outlined in the 2003 Revised JLRMP are based on the guidelines of the 1997 IBRS and are designed to: 1) protect hibernacula; 2) maintain and enhance upland and riparian swarming and foraging areas; and 3) identify and protect summer roosting and maternity site habitat. Like the IBRS, conservation measures identified in the Revised JLRMP to protect and promote Indiana bats and their habitat are applied at three scales:

1) A **primary cave protection area** consisting of a radius of no less than one half mile around each hibernacula, defined by National Forest surface ownership and topography. This area is intended to protect the integrity of the cave and the immediate surrounding uplands where bats may swarm and forage in the fall.

2) A **secondary cave protection area** consisting of a radius of approximately 1½ miles around each primary cave protection area, defined by easily recognizable features on the ground. This area is managed to further maintain and enhance swarming, foraging, and roosting habitat.

3) Because Indiana bats are known to travel over 200 miles between winter and summer habitats, standards are also applied to the Jefferson National Forest as a whole since the entire Forest is potential habitat for the species. These standards

are designed to protect foraging areas, non-cave associated roosts, and maternity sites, if any are discovered on the Forest.

Further explanation of how these distances were developed is found in the Forest Service's 2003 Biological Assessment and the 1997 IBRS. The 0.5-mile primary area and 1.5-mile secondary area around a hibernaculum is delineated on the ground by using National Forest/private land ownership boundaries and noticeable man-made and landform features (i.e. roads, trails, streams, ridgetops, etc.). In most cases the actual boundary when drawn is greater than 0.5 or 2.0 miles from the cave due to the nature of ownerships and man-made features and landforms. The lines were drawn by placing 0.5-mile and 2.0-mile circles on a map around each hibernaculum. Then the actual boundary was drawn using the noticeable land features. When a decision was necessary +/- from the circle, the line was always drawn greater than the circle indicated. This is discussed in standards of the Revised Jefferson NF Plan under prescription 8.E.4 – Indiana Bat Hibernacula Protection Areas and illustrated on maps showing prescription allocations.

The 2003 Revised JLRMP identifies that of the total 723,300 acres on the JNF, approximately 464,000 acres (64% of the JNF land base) are unsuitable for timber harvest due to low productivity, steepness of slope, visual concerns, wilderness designation, and other resource management priorities. These lands will provide a continuous supply of roost trees and foraging areas for Indiana bats. These are well distributed across the JNF and occur intermixed with those stands in the land base suitable for timber harvest. The management actions that are the subject of this consultation will occur primarily on the remaining 259,300 acres of the JNF. Appendix B provides the specific standards and conservation measures for the Indiana bat proposed in the Revised JLRMP, and is pertinent to the evaluation of the effects of the JLRMP on the Indiana bat.

II. RANGEWIDE STATUS OF THE SPECIES

Species Description

The Indiana bat is a monotypic species (there are no subspecies) of the genus *Myotis* that is known to occur in much of the eastern half of the United States. These bats are medium-sized with head and body length of individuals range from 41 to 49 millimeters (mm) (1 5/8 - 1 7/8"), and forearm length of 35-41 mm (1 3/8 - 1 5/8") (USFWS 1983). This species is similar in appearance to both the little brown bat (*M. lucifugus*) and the northern long-eared bat (*M. septentrionalis*). The Indiana bat often has a distinctly keeled calcar (cartilage that extends from the ankle to support the tail membrane). The hind feet tend to be small and delicate with fewer, shorter hairs (i.e., do not extend beyond the toenails) than its congeners. The fur lacks luster (Barbour and Davis 1969; Hall 1981). The ears and wing membranes have a dull appearance and flat coloration that do not contrast with the fur. The fur of the chest and belly is lighter than the flat (not glossy), pinkish-brown fur on the back, but does not contrast as strongly as does that of the little brown or northern long-eared bat (Clawson, pers. observ. as cited in USFWS 1996). The skull has a small sagittal crest, and the braincase tends to be smaller, lower, and narrower than that of the little brown bat (Barbour and Davis 1969; Hall 1981).

The species was listed as endangered by the FWS pursuant to the Endangered Species Preservation Act (ESPA) on March 11, 1967. Species listed under ESPA carried over and became listed by the Endangered Species Act when it became law in 1973. A recovery plan for

the species was completed on October 14, 1983. In October 1996, the Indiana Bat Recovery Team released a Technical Draft Indiana Bat Recovery Plan. In October 1997, a preliminary version entitled "Agency Draft of the Indiana Bat Recovery Plan," which incorporated changes from the 1996 Technical Draft, was released. Subsequently, an agency draft entitled "Indiana Bat (*Myotis sodalis*) Revised Recovery Plan" was distributed for comments in March 1999. A final revision is still in preparation. Critical habitat was designated for the species on September 24, 1976 and includes 11 caves and 2 abandoned mines. The following sites have been designated as critical habitat for the Indiana bat: Bat Cave in Carter County, Kentucky; Coach Cave in Edmonson County, Kentucky; White Oak Blowhole Cave in Blount County, Tennessee; the Blackball Mine in LaSalle County, Illinois; Big Wyandotte Cave, Crawford County, Indiana; Ray's Cave, Greene County, Indiana; Cave 021, Crawford County, Missouri; Cave 009, Franklin County, Missouri; Cave 017, Franklin County, Missouri; Pilot Knob Mine, Iron County, Missouri; Bat Cave, Shannon County, Missouri; Cave 029, Washington County, Missouri; and Hellhole Cave, Pendleton County, West Virginia. No critical habitat has been designated in Virginia or near the Jefferson National Forest.

Life History

Indiana bats hibernate in caves and mines that provide specific climatic conditions, preferring hibernacula with stable winter temperatures below 10 degrees Celsius and relative humidity above 74% (USFWS 1999). Recent examination of long-term data suggests optimal temperatures range from is 3-7 degrees Celsius (Richter et al. 1993, Tuttle and Kennedy 2002). Stable low temperatures allow the bats to maintain a low rate of metabolism and conserve fat reserves through the winter until spring (Humphrey 1978; Richter et al. 1993). Because few caves or mine shafts provide these exacting conditions, approximately 52% of the species' total population hibernates in only seven caves and one abandoned mine shaft (Clawson 2002).

Indiana bats undergo swarming prior to hibernation, an activity that entails bats congregating around the hibernacula, flying into and out of the cave, and roosting in trees outside (Kiser et al. 1996). Swarming continues for several weeks, during which time the bats mate and replenish fat reserves prior to hibernation (USFWS 1983). Figure 1 provides a depiction of the Indiana bat's annual life cycle. During the swarming season, both males and female bats roost under sloughing bark and in cracks of dead, partially dead and live trees in close proximity to cave entrances prior to hibernation (MacGregor et al. 1999). Depending on local weather conditions, swarming may continue through October or November. Males generally remain active longer than the females during this pre-hibernation period, but all Indiana bats are usually hibernating by late November (USFWS 1983). Indiana bats typically hibernate in dense clusters, with bat densities ranging in size from 300 to approximately 500 individuals per square foot (Clawson et al. 1980). Indiana bats select roosts within hibernacula that best meet their needs for cool temperatures; in many hibernacula, these roosting sites are near an entrance, but may be deeper in the cave or mine if that is where the cold air flows and is trapped (Tuttle and Stevenson 1978). Females emerge from hibernation first (generally in late March or early April). Although most hibernating colonies leave the hibernacula by late April, some males may spend the summer in the vicinity of the hibernaculum. Those leaving the hibernaculum migrate varying distances to their summer habitats.

Figure 1. Indiana Bat Annual Chronology (USFWS 1999).

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Both sexes:											
Hibernation								Hibernation			
Females:			Emerge	Pregnant			Swarming				
"					Lactating						
Young:					Born	Flying					
Males:			Emerge				Swarming				
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

During the summer months, male and female Indiana bats typically roost during the day beneath loose or exfoliating bark in snags (dead standing trees) or living trees. To a limited extent, tree cavities or hollow portions of tree boles and limbs also provide suitable roost sites (Gardner et al. 1991a, Kurta et al. 1993b). Reproductive females form maternity colonies that may be hundreds of miles from the hibernacula, and females in a maternity colony may come from more than one hibernaculum. In contrast, males often use wooded areas near the hibernaculum, occasionally visiting the hibernaculum throughout the summer. Although less migratory than females, males sometime migrate long distances to summer habitat. During this time, males often roost individually, and likely use trees similar in character to those used near hibernacula in autumn and spring.

Females store sperm through the winter and become pregnant via delayed fertilization soon after emergence from the hibernacula. In the Spring, adult females roost in maternity colonies that may include more than 100 bats (Callahan et al., 1997) under loose bark or in cavities of snags or mature live trees in riparian or upland forests. Adults forage on winged insects usually within three miles of the occupied maternity roost (Gardner et al. 1991a). Each female gives birth to a single young in late June or early July and the young can fly in approximately one month. By late August, the maternity colonies begin to disperse. Reproductive females often roost in forested habitat and may require multiple alternate roost trees to fulfill summer habitat needs. Indiana bat maternity sites generally consist of one to several primary maternity roost trees (i.e., trees used repeatedly by relatively high numbers of bats in the maternity colony during the maternity season) and varying numbers of alternate roost trees (i.e., those trees used by smaller numbers of bats throughout the course of the maternity season). Primary roost trees that have been studied to date have ranged in size from 12.2 to 29.9" dbh (Romme et al. 1995). Studies have shown that adults in maternity colonies may use as few as two, to as many as 33 alternate roost trees (Humphrey et al. 1977; Gardner et al. 1991a; Garner and Gardner 1992; Callahan 1993; Kurta et al. 1993a; Romme et al. 1995; Kurta et al. 1996). Alternate roost trees also tend to be large, mature trees, but the range in size is somewhat wider than that of primary roosts (7.1 to 32.7 inches dbh) (Romme et al. 1995). In Missouri, maximum distances between roost trees used by bats from the same maternity colony have ranged from 1.0 to 1.9 miles (Callahan 1993). Snags exposed to direct solar radiation were found to be used most frequently by Indiana bats as summer roosts, followed by snags not fully exposed to solar radiation and live trees not fully exposed (Callahan 1993).

Until recently, most documented Indiana bat maternity colonies were located in riparian or floodplain forests (Humphrey et al. 1977). However, recent studies and survey results indicate that upland forests provide important maternity habitat for Indiana bats (Gardner et al. 1990; Romme et al. 1995). In addition, females are known to exhibit relatively strong loyalty to summer roosting and foraging habitat (Bowles 1981; Gardner et al. 1991a, 1991b).

Indiana bats are known to occupy distinct home ranges during the summer (Gardner et al. 1990). Average home range sizes vary from approximately 70 acres (juvenile males) to over 525 acres (post-lactating adult females). Roosts occupied by individuals ranged from 0.33 miles to over 1.6 miles from preferred foraging habitat, but are generally within 1.2 miles of water (e.g., stream, lake, pond, natural or manmade water-filled depression). A more detailed description of the life history of the Indiana bat is provided in the Indiana Bat Recovery Plan (USFWS 1983) and the Revised Technical Draft Indiana Bat Recovery Plan (1996).

A habitat suitability index model was developed for the Indiana bat (Romme et al. 1995), which identifies nine variables that comprise the components of summer habitat for the species. The model was developed for use in southern Indiana, a core area of the Indiana bat population. Therefore, caution must be applied to peripheral areas within the species' range, such as Virginia and the JNF. Five variables considered important for roosting habitat within analysis areas included: amount of overstory canopy, diameter of overstory trees, density of potential live roost trees, density of snags, and the amount of understory cover. Variables considered to be important foraging habitat components in southern Illinois included the amount of overstory canopy and the percentage of trees in the 2 to 2.7 inch dbh class. Distance to water, and percentage of the analysis area with forest cover were also considered to be important habitat variables: habitat with distance to water of 0 to 1.5 km (0-1 mile) and percent of forested land greater than 30% received high use.

The habitat model classified species of trees that may provide roosts for Indiana bats. Class I trees, identified as those most frequently used as roosts, include: silver maple, shagbark hickory, shellbark hickory, butternut hickory, green ash, white ash, eastern cottonwood, red oak, post oak, white oak, slippery elm, American elm. Shagbark and butternut hickory, red and white oak, and white ash are tree species typical of southern Appalachian mixed hardwood forests and are commonly found on JNF.

Class I trees are likely to develop the loose, exfoliating bark as they age and die that is preferred by Indiana bats for roosting sites. However, several of these species are typical of bottomland hardwood forests in areas where much of Romme's research was done, and they do not occur in significant numbers on the JNF. Romme also identified Class II trees, which include sugar maple, shingle oak, and sassafras as tree species believed to be of somewhat lesser value for roosting Indiana bats. Class III trees are all other species not included in the other two classes. In addition, Class II and III trees are species that are less likely to provide optimal roosting habitat, but may develop suitable cracks, crevices, or loose bark after death.

Preferred roost sites are in trees that are 9 inches (22 cm) or larger in dbh and are located in forested habitat where the degree of overstory canopy cover ranges from 60-80%. In general, the largest available trees with suitable bark characteristics and at least some daily exposure to sunlight are the most likely to be used by Indiana bats as maternity roosts. The suitability of a

given area as roosting habitat declines slightly as canopy closure increases from 80-100%, and also declines as canopy closure falls below 60% (Romme et al. 1995).

Indiana bats prefer to forage within the upper canopy layers of forests where the degree of overstory canopy cover ranges from 50-70%. The suitability of a given area as foraging habitat declines slightly as canopy closure increases from 70-100%, and also declines as canopy closure decreases below 50% (Romme et al. 1995). Foraging also takes place over clearings with early successional vegetation, along the forested borders of agricultural land, and along strips of trees extending into more open habitats.

Drinking water is essential when bats actively forage. Throughout most of the summer range, Indiana bats frequently forage along riparian corridors and obtain water from streams. However, studies in the Cumberland Plateau and Cumberland Mountains of eastern Kentucky (MacGregor et al. 1996) indicated that riparian habitats there received very little use, and natural and man-made ponds and water-filled road ruts in the forest uplands were very important water sources for Indiana bats in those regions.

Status and Distribution

The distribution of Indiana bats is generally associated with limestone caves in the eastern U.S. (Menzel et al. 2001). Within this range, the bats occupy two distinct types of habitat. During winter, the Indiana bat hibernates in caves (and occasionally mines) referred to as hibernacula. Bats are often readily found and easily counted at this time. Census of hibernating Indiana bats is the most reliable method of tracking population trends range-wide. As such, winter distribution of the Indiana bat is well documented. Less is known about the abundance and distribution of the species during the summer maternity season, and even less is known about its migratory habits and associated range.

According to the known and suspected range of the Indiana bat presented in the species' recovery plan (USFWS 1983, 1999), the Indiana bat is a migratory species that ranges over an area of approximately 580,550 square miles in the eastern half of the United States. Over 52% of the known range-wide population of Indiana bats occupy eight "Priority One" hibernacula (hibernation sites with a recorded population >30,000 bats since 1960), three each in Indiana and Missouri and two sites in Kentucky (Clawson 2002). Smaller populations of hibernating Indiana bats are known from Alabama, Arkansas, Connecticut, Florida, Georgia, Illinois, Iowa, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin. Although the winter range is large, the known population of the species has been found in only 336 hibernacula in an area with tens of thousands of caves and mines.

"Priority Two" hibernacula (recorded population >500 but <30,000 bats since 1960) are known to occur in Indiana, Kentucky, and Missouri as well as Arkansas, Illinois, New York, Ohio, Tennessee, Pennsylvania, Virginia, and West Virginia. Priority Three hibernacula (recorded populations of <500 bats or single hibernating individuals) have been reported in the all the states with known Indiana bat hibernacula.

Many hibernacula populations have been decreasing in numbers since monitoring efforts were initiated. The most serious declines have occurred in two of the three historically highest

populated states for Indiana bats, Kentucky and Missouri. Kentucky numbers declined by an estimated 200,000 bats between 1960-2001 (Clawson 2002). Losses were attributed to exclusion and changes in the microclimate of two of the three most important hibernation sites in the state. More specifically, poorly designed cave gates (Humphrey 1978) and construction of buildings over the upper entrance to one of the hibernacula (J. MacGregor, Daniel Boone National Forest, pers. observ. cited in USFWS 1996) appeared to have caused great declines. Many of the most important remaining hibernating populations (west-central, northeastern, and extreme southeastern Kentucky) have continued to decline steadily in the last 20 years. The colonies of Indiana bats in all of the 16 known Priority One and Two hibernacula in Missouri have declined since 1980. Despite efforts such as cave gating, the overall Missouri population has steadily and drastically declined by 269,000 bats between 1980 and 2001 (Clawson 2002). These losses represent more than 80% of the population (USFWS 1996). Likewise, Clawson (2002) reported an 80% decrease over the last 40 years over the southern portion of the Indiana bat's range (Alabama, Arkansas, Kentucky, Missouri, Tennessee, and Virginia).

Although overall known Indiana bat numbers have declined since 1960, populations in the northern Midwest and Northeast including populations in New York, Pennsylvania, West Virginia, Ohio, Illinois, and Indiana appear to have increased by 30% (Clawson 2002).

Based on censuses taken at hibernacula in 1999, the total known Indiana bat population was estimated to be approximately 350,000 bats (FWS 1999). The current estimated range-wide population of Indiana bats is 382,350 individuals, which hibernate in 336 hibernacula (Clawson 2002). The eight largest "Priority One" hibernacula contained 198,000 Indiana bats, or 52% of the total known population. The 69 hibernacula classified as "Priority Two" contained 171,000 Indiana bats, or 45% of the total known population (Rocky Hollow Cave is in this category). The remaining 259 caves known to have been occupied by Indiana bats contained only 14,000 bats, less than 4% of the total population (three other hibernacula on or near the Jefferson National Forest – Kelly, Newberry-Bane, and Shires Cave – are in this category).

Much less is known about the location of maternity colonies or the migration patterns of the Indiana bat. Although the majority of known maternity colonies occur in Midwestern states such as Ohio and Indiana, there have been documented maternity colonies in Kentucky and North Carolina, and some limited evidence to suggest the presence of maternity colonies in Virginia and West Virginia. A juvenile male was discovered in West Virginia on August 5, 1999 (Kiser et al. 1999). It is not known whether the juvenile bat had immigrated from a distant or resident maternity colony. Similarly, a juvenile male was captured on July 28, 1992 in Cumberland Gap National Historic Park, Lee County, Virginia (Hobson 1993). Despite these findings, no lactating females or actual maternity colonies have been reported in Virginia or West Virginia to date.

Status in Virginia

In Virginia, 11 hibernacula are currently known from 7 counties (Bath, Bland, Craig, Highland, Lee, Tazewell, and Wise) and continue to support varying numbers of Indiana bats. The Virginia Fish and Wildlife Information Service has additional historic records of Indiana bats wintering in Dickenson, Giles, Montgomery, and Shenandoah Counties (Virginia Department of Game and Inland Fisheries). Critical habitat for the Indiana bat has not been designated in Virginia.

The Indiana bat has been documented in southwestern Virginia since the mid-1960s. In the early 1960s, the state's Indiana bat population was estimated at over 5,000. In 1997 the state's population was estimated to be 1,840 bats. The Recovery Team (USFWS 1999) considered the data from Virginia too sketchy for trend analysis. The 2000-2001 survey for hibernating Indiana bats in Virginia totaled 833 individuals, but the hibernaculum in Tazewell County was not surveyed that season. The entrance to this cave is dangerously unstable. The last survey in that cave was on January 21, 1999, and yielded 136 Indiana bats. Results of the 2002-2003 survey show an estimated number of hibernating Indiana bats in Virginia at 1081 (10 of the 11 known hibernacula were surveyed; hibernaculum in Tazewell County was inaccessible), less than 0.3% of the total population (Rick Reynolds, VDGIF, pers. comm. 2003). This represents an approximate 57% decline in the population since Dalton (1987) found 2,500 Indiana bats hibernating in eight caves during a 10-year survey of 170 caves in 22 Virginia counties.

Humphrey (1978) acknowledged the increasing importance of these small populations of Indiana bats in management of the species if the larger populations continue to decline. In addition, genetic composition of populations at the edge of a species' range may differ considerably from that at the center of the species' range (Mayr 1954, 1963, 1982).

In 1977, the VDGIF began distribution surveys for cave-dwelling bats in Virginia. A total of 170 caves in 22 counties were surveyed (Dalton 1987). Indiana bats were located in 8 caves in 5 counties. Indiana bats were not found in four historic sites, but five new sites were located. Additional surveys have since located three new caves that house small populations of Indiana bats (R. Reynolds, VDGIF, pers. comm. as cited in the 1997 Biological Opinion). The continued decline of *M. sodalis* numbers in Virginia through the 1980s prompted gating efforts in the 1990s. Of the 11 known hibernacula in Virginia, eight have been gated to reduce or eliminate human disturbance, two are under negotiation, two are believed to be protected due to land ownership, and two will not be gated due to landowner concerns (R. Reynolds, VDGIF, pers. comm. 2003). Surveys of the caves containing threatened or endangered species, including Indiana bats, are ongoing.

Hobson (1993) surveyed the areas associated with known *M. sodalis* hibernacula in western Virginia (Lee, Tazewell, Wise, Scott, Bland, Bath, and Highland Counties) in 1992 during 50 "net nights" at 40 sites. The primary objective of the study was to determine various aspects of summer ecology, distribution, and abundance of bats, with emphasis on the Indiana bat. All 40 net sites were located along riparian corridors and other natural or man-made corridors in upland and lowland areas. No female Indiana bats were captured. However, one juvenile male was captured on July 28, 1992, along Station Creek in Cumberland Gap National Historic Park (CGNHP). Five male Indiana bats were captured in CGNHP along Station Creek, and Lewis Hollow Branch, within 3 miles of Cumberland Gap Saltpeter Cave, which harbors the largest known hibernating colony of Indiana bats in Virginia. A single male was captured along the Cowpasture River in Highland County, within 2 miles of Hupman's Saltpeter Cave, which harbors an estimated 225 Indiana bats during the winter. The five Indiana bats found in CGNHP were using small permanent or intermittent streams in heavily wooded areas as flyways. The single male captured in Highland County was using a disturbed portion of the Cowpasture River, approximately 50 ft. wide, which contained no water on the date of capture. This study documented that at least male individuals of Indiana bats use habitat in the vicinity of known hibernaculum in Virginia during the summer. In addition, the capture of a single juvenile male

suggests that at least one nursing female may be using habitat in the Cumberland Gap area (which could include Virginia and/or Kentucky and/or Tennessee).

Rocky Hollow Cave, which occurs adjacent to the Clinch Ranger District of the JNF, supported one of the largest Indiana bat populations in Virginia. In the 1960s, Dr. Tuttle (Bat Conservation International, pers. comm. as cited in the 1993 GWJNF's biological assessment) visited this site and observed approximately 1,200 Indiana bats. The 2003 survey results show as few as 325 Indiana bats at this site. The Nature Conservancy, in cooperation with the FWS and VDGIF, has recently gated Rocky Hollow Cave.

Hellhole Cave, a site designated as critical habitat for the Indiana bat, occurs in Pendleton County, West Virginia, and contains approximately 8,566 Indiana bats (last surveyed Winter 2001) (Graig Stihler, West Virginia Department of Natural Resources, pers. comm. 2003). The cave is approximately 90 air miles north northeast of the JNF.

Threats to the Species

A number of identified factors have likely contributed to the decline of the Indiana bat throughout its range, with the most significant being human disturbance of hibernating bats and vandalism. Human entry into a hibernaculum during the winter causes the bats to awaken. Each time a bat awakens, it utilizes some of the fat reserves it has accumulated for the winter. Frequent disturbance may cause the bats to use up all of their stored fat reserves, forcing them to leave the cave too early in the year to search for food, likely resulting in starvation. Vandalism is also a serious problem that has resulted in deliberate destruction of many bat colonies simply because these animals are often viewed by the public as nuisances or threats to human health.

Other possible causes of decline of Indiana bat populations include natural disasters, alteration of habitat (summer maternity and winter hibernacula), and chemical poisoning. Caves occupied by Indiana bats (and other bat species) occasionally flood or collapse, killing a few, to thousands of bats. Timber harvest, water quality degradation, stream channelization, and other actions can, in some cases, result in destruction or alteration of actual or potential roosting and/or foraging habitat. However, it should be noted that the location of suitable Indiana bat roost trees across the landscape changes over time as various trees develop or lose bark, or as the trees die and fall. In addition, Indiana bats frequently change roost trees as particular trees become unsuitable and other become suitable as roosts. It is not currently known how long or how far female Indiana bats will search to find new roosting habitat if traditional habitats have been destroyed or rendered unsuitable. If they are required to search for prolonged periods of time after emerging from hibernation in the spring, this effort may place additional stress on the females at a time when they are already expending significant amounts of energy.

The impacts of herbicide use on Indiana bats have not been studied, but insecticides are thought to have contributed to the decline of other insectivorous species of bats (Clark 1981). Insecticides, particularly those used for forest pests, could have both direct (potential of a bat eating a contaminated insect) or indirect effects (loss of the species forage base since most insecticides are not very specific). It is possible that herbicide use (e.g., aerial application) could have indirect impacts on the Indiana bat by potentially reducing vegetation, and consequently the insect population numbers or diversity, in the treatment area. This potential indirect effect, however, would not be anticipated to be significant with the typical irregular use of herbicides.

In addition, the exposure of bats to open oil pits in some states has resulted in direct mortality of individuals (many unable to be identified by species).

Historic collecting, handling, and banding by biologists are also thought to have contributed to declines in Indiana bat population numbers. During the winter, these activities cause hibernating bats to awaken and utilize stored fat reserves; during the summer they may disturb sensitive maternity colonies. Winter counts are now conducted on a biennial basis. Banding of bats collected by mistnetting during the maternity season, however, is thought to have negligible effects on bats.

Poorly designed and installed cave gates restrict bat movement and alter air flow into caves. Air flow alterations may change the climatic conditions and render the cave unsuitable for hibernation. Commercialization of caves results in disturbance to summer or hibernating bat colonies, and impoundment of streams result in permanent or seasonal flooding of caves (USFWS 1983).

Recovery Goals and Accomplishments

Recovery for the Indiana bat depends to a large extent on maintaining the ecological integrity of essential hibernacula and protecting these areas from human disturbance (USFWS 1983). In addition, foraging habitat (including riparian forest vegetation, dead trees) must be maintained, protected, and restored. Lastly, in order to evaluate the success of protection efforts, a monitoring program is needed to document changes in Indiana bat populations.

Delisting will be considered when: (a) criteria listed above are fulfilled; and (b) protection and documentation of increasing or stable populations occurs for three consecutive census periods at 50% of the Priority Two caves in each state (USFWS 1983).

More specifically, the recovery outline entails the following:

1. Prevent disturbance to important hibernacula by: (a) preventing entry; (b) preventing adverse modifications to winter and fall roost sites; (c) protecting winter and fall roost sites.
2. Maintain, protect, and restore foraging and nursery roosts by preventing adverse modification to foraging area and nursery roost habitat.
3. Monitor population trends.
4. Public education.
5. Research needs.

Thirteen mines or caves have been designated as critical habitat for the Indiana bat (found within Illinois, Indiana, Kentucky, Missouri, Tennessee, and West Virginia). In general, priority levels for protection of hibernacula have been based on recorded populations of the Indiana bat within each hibernacula. Since the priority designation for hibernacula was developed in 1983, an active set of programs at the state and Federal levels have led to the acquisition and protection of a number of Indiana bat hibernation caves. Of 127 caves/mines with populations >100 bats, 54 (43%) are in public ownership or control. In addition, approximately 46 (36%) hibernacula (most on public land) were gated or fenced as of 1996 (USFWS 1996).

Additional recovery criteria are currently being considered and a revised Indiana Bat Recovery Plan is currently under review (USFWS 1996).

III. ENVIRONMENTAL BASELINE IN THE ACTION AREA

The JNF extend along Virginia's western boundary east of West Virginia from Lexington, Virginia south to Kentucky. Of the approximate 723,300 acres that comprises the JNF, 716,400 acres are forested and 6,900 are non-forested including water bodies. The Forest lies in the Ridge and Valley physiographic province, the Blue Ridge physiographic province, and the Appalachian Plateau physiographic province. These publicly owned lands are located in 19 Virginia counties (703,300 acres), one West Virginia county (19,000 acres), and two Kentucky counties (1,000 acres). Elevations on the JNF reach their highest elevation of 5,729 feet on Mount Rogers (the highest point in Virginia) in Grayson County, Virginia. Topography is generally characterized by long linear parallel mountains with steep side-slopes, narrow ridge tops, and narrow stream valleys in a trellis drainage pattern. Lands under Forest Service management are distributed primarily on the sides and tops of mountains along with associated spur-ridges. Most adjacent privately-owned lands are located in intervening valleys and in scattered small acreage inholdings on the mountains.

The limited karst formations (closed depressions, sinkholes, underground caverns, solution channels) of the JNF are found in scattered valley settings within the Ridge and Valley and Appalachian Plateau where carbonate bedrock (limestone and dolomite) are near the surface or in windows exposing Ordovician age Knox group strata and Cambrian age Shady dolomites beneath thrust sheets of clastics along the western edge of the Blue Ridge Mountains (Holsinger 1975). In Virginia, there are approximately 4,100 caves scattered along the western edge of the state (Wil Orndorff, Virginia Department of Conservation and Recreation, Division of Natural Heritage, pers. comm. 2003). To date, 39 caves have been recorded as occurring on lands managed by the JNF.

In 1997, a Biological Opinion (BO) was issued by the FWS to the FS regarding activities outlined in the Land and Resource Management Plans for both the GWNF and JNF, and their effects on the Indiana bat. The incidental take statement in the 1997 BO anticipated annual removal or disturbance to no more than 4,500 acres of potential Indiana bat habitat and that no more than ten Indiana bats would be incidentally taken within the GWJNF annually. To date, no dead Indiana bats have been found on either of the National Forests, although the chance of finding a dead individual of this species is small. Table 1 shows the combined acreage of habitat disturbance from activities other than prescribed burning for the combined GWJNF. An average of 808 acres per year of forested habitat has been disturbed on the Jefferson National Forest since 1997, based on the information provided by the Forest Service. When combined with the average annual prescribed burning of 2500 acres on the JNF, the total average Indiana bat habitat that has been disturbed on the JNF is approximately 3300 acres per year.

Table 1. Trend in removal of or disturbance to potential Indiana bat habitat on the GWNF and JNF (unit of measure = acres).

Year (fiscal)	Timber GWNF	Timber JNF	*Total Timber Harvested	*Road Const.	*Rx Burn Line Const.	*Recreation Develop.	*Wildlife Opening Develop.	*Special Use Develop.	*Grand Totals
1998	1,449	1,293	2,742	3.15	15.8	40	7.5	5.8	2,814.25
1999	1,284	942	2,226	3.2	10.2	23	9.0	15.5	2,286.9
2000	1,254	1,115	2,369	0.1	12.7	11	14.4	12.3	2,419.5
2001	1,162	795	1,957	2.8	13.8	15	12.5	7.1	2,008.2
2002	881	332	1,213	0.3	15.1	10.5	8.0	4.2	1,251.1
2003	789	226	1,015	0.2	12.3	6.2	10.1	8.3	1,052.1

= acres for both GW & JNF

Under the 2003 Revised LRMP, the JNF manages a total of approximately 723,300 acres with 258,900 forested acres (36%) (based on Continuous Inventory of Stand Conditions (CISC) acreage) considered suitable for timber production. The remaining 464,000 acres (64%) are deemed unsuitable for timber production due to low productivity, steepness of slope, visual concerns, wilderness designation, and other resource management priorities. Over 74% of the forest on the JNF is currently greater than 70 years old (approximately 521,182 acres). Over the next 30 years, an expected 77,473 acres will move into the over 70 year old age class, increasing the mature forest condition acreage to 598,655 or 85% of the total forested acres.

Hardwood and hardwood-pine forest types have the highest likelihood of providing suitable summer roosting sites for the Indiana bat. The current CISC data indicates that approximately 21% of the JNF land base (146,700 acres) is typed as Dry and Dry Mesic Oak-pine with most trees currently in the 9" dbh or larger size class (age class 41-80 years). Approximately 67% of the JNF land base (473,400 acres) is typed as Mixed Mesophytic (12%), Dry Mesic Oak (38%), and Dry and Xeric Oak (17%) with most trees currently in a size class greater than 16" dbh (>80 years old). Therefore, a minimum of 88% of the forested land base (620,100 acres) is likely to provide the species and size classes of trees suitable for potential roost sites for Indiana bats. The remaining acres of the JNF are in vegetation types such as yellow pine, montane spruce-fir, northern hardwoods, white pine/hemlock, or grasslands, which are not considered suitable vegetation for summer roost sites. In addition, the Revised JLRMP recognizes approximately 51,500 acres as "old growth" forest (generally greater than 130 years). Of those 51,500 acres, 33,400 (65%) will not have timber harvest activities. Harvest determinations on the remaining 18,100 acres of dry-mesic oak dominated forests will be determined on a case-by-case basis.

Approximately 73,600 acres of riparian buffers (10% of the JNF land base) are located adjacent to approximately 1,053 miles of perennial stream and 1,970 miles of intermittent streams within the JNF. The JNF contains 15 impoundments greater than 1 acre in size for flood control and drinking water, as well as smaller impoundments built for recreational use. In addition, at least 335 small ponds less than 0.25 acres in size are located across the Forest that support various forms of wildlife. In total, approximately 348 acres of lakes, ponds, and reservoirs greater than acre in size occur within the JNF.

Status of the Species in the Action Area

Populations of the Indiana bat hibernating in the JNF typify a peripheral population in that they occur on the eastern edge of their range and represent roughly 0.14% of the current total estimated population. Five caves that support hibernating Indiana bats occur on or near the Jefferson National Forest, four of which are gated to control human access (Table 2). Newberry-Bane Cave is not gated but access is strictly controlled by the private landowners. Two (Shires Cave and Kelly Cave) of the eleven known hibernacula in Virginia occur on the JNF providing for a portion of the estimated 1,081 individuals statewide (approximately 2.5% of the known Virginia population).

Table 2. Indiana bat populations within hibernacula on or near the JNF since 1970. Adapted and modified from the 2003 Biological Assessment for the JLRMP.

	Number of Bats Counted				
Winter Survey Year	Shires Cave, VA**	Newberry-Bane Cave, VA	Kelly Cave, VA**	Rocky Hollow Cave, VA	Patton Cave, WV
1970				1,200	
1978				750	
1981					3
1984				647	
1985				270	
1986		90	1		
1988	13				0
1989	13				
1990	3	120			
1991				202	
1992		100			
1993	20	107	18	241	
1994					
1995		110			
1996	27				
1997			10*		
1998					17
1999	23	120	10		
2000		235			8
2001	36		3	166	
2002					10
2003	19	189	9	325	

Blank cells = no survey done that winter or data not available
*Incomplete survey of Kelly Cave was done in 1997
**Cave located on Forest Service land

Steps have been taken by the Jefferson National Forest to protect these caves for the Indiana bat. In 1995, bat gates were installed in the entrance of Shires Cave on the New Castle Ranger

District and Kelly Cave on the Clinch Ranger District. Kelly Cave has historically received heavy recreational visitation. Prior to gating, some cave rescues occurred in the winter months confirming recreational use of the site during the hibernation period. The most recent (2003) survey indicated the presence of nine hibernating Indiana bats (R. Reynolds, VDGIF, pers. comm. 2003). Shires Cave historically appeared to have less human use prior to gating, but vandalism of cave closure signs indicated visitation at this site. In 2003, nineteen Indiana bats were observed during the winter count (R. Reynolds, VDGIF, pers. comm. 2003), a decrease in number from the 2001 count of 36. Rocky Hollow Cave, Newberry-Bane Cave, and Patton Cave are on private land, but are located 0.32, 0.25, and 1.08 miles from JNF land, respectively. Therefore, portions of the primary and/or secondary cave protection areas extend onto the Forest. Cave Springs Cave (Clinch Ranger District) has been gated but is not currently known to be a hibernaculum for any rare bat species (however, it has the potential to serve as a hibernaculum) and is known to contain a variety of rare troglobitic amphipods and isopods.

In an attempt to learn more about summer foraging, roosting and potential use of the GWJNF by Indiana bats, Hobson and Holland (1995) initiated a study in the spring of 1993. The purpose of the study was to determine if male Indiana bats wintering in a Virginia cave remained in the vicinity of the hibernaculum during spring and summer months, and to characterize foraging and roosting habitats of male Indiana bats. The study took place within the George Washington NF in proximity to Starr Chapel Cave, Bath County, in the Warm Springs Ranger District. On April 28, 1993, two male Indiana bats were captured at the cave and fitted with radio transmitters. They were observed (radio telemetry located) for two weeks (until transmitter battery failure) and subsequently followed with night vision goggles and ultrasonic detectors. One of the male bats was never located from the ground after release, but its signal was detected by an aircraft in the cave area May 8 and 10, 1993. The other male bat foraged in the GWNF until May 20, 1993 when the transmitter battery failed. For 19 days, the bat roosted in a mature (98 feet tall, dbh of 24") live shagbark hickory above Back Creek near the Blowing Springs Campground (approximately 10 air miles southwest of Starr Chapel Cave hibernacula). The roost tree was located on a steep, north-facing slope at an elevation between 667 to 758 meters (2,187 to 2,486 feet). The surrounding forest consisted of mature shagbark hickory, pignut hickory, American basswood, red maple, red oak, and tulip poplar. The male bat foraged over mature forest and riparian areas near the roost tree, encompassing approximately 625 ha (1,540 acres). In addition, ten other bats were observed roosting in the same tree. While netting efforts did not capture these bats, discussions with other Indiana bat researchers led the FS to believe that these were also Indiana bats (R. Reynolds, VDGIF, pers. comm. as cited in the 1997 Biological Opinion). This was the first evidence that Indiana bats roosted and foraged on the GWNF during summer months.

It is difficult to quantify summer roosting habitat for the Indiana bat at a range-wide, regional, or local level due to the variability of known roost sites and lack of knowledge about landscape scale habitat characteristics. According to recent telemetry studies, Indiana bats appear to be very adaptable, living in highly altered landscapes and are somewhat dependent on ephemeral resource (dead or dying trees). Two recent telemetry studies in Virginia documented use of a variety of habitats within 2 miles of two caves on the JNF (Nutt 2001, Brack and Brown 2002). In late September 1999, four Indiana bats (3 males, 1 female) were trapped and fitted with radio transmitters at the entrance of Rocky Hollow Cave in Wise County, Virginia (Nutt 2001). From September 23rd to October 13th (21 days) three roost trees were located (all on private land) that

were used by two of the bats (one male and one female). The female used two different trees in open woodlands approximately 1.5 miles southwest of the cave near the Lonesome Pine Country Club. One was a shagbark hickory 19" dbh and the other was a yellow poplar with peeling bark that had been damaged during a logging operation located next to a skid-road. The tree occupied by the male bat was used as a roost on multiple days and was a pignut hickory 28" dbh located 0.15 miles north of the cave. Other observations made during the course of the study included extensive foraging activity over hayfields and along edges of forests and fields.

During September and October of 2000, an extensive survey was made of fall swarming activity near Newberry-Bane Cave in Bland County, Virginia as part of the proposed American Electric Power (AEP) 765kv Wyoming (WV) to Jacksons Ferry (VA) powerline project (Brack and Brown 2002). Of 27 Indiana bats captured (24 males and 3 females) at the mouth of Newberry-Bane Cave, 17 (14 males and 3 females) were fitted with transmitters. Radio-tagged bats were monitored between September 9 and October 21 within 2-miles of the cave entrance.

Information gathered by Brack and Brown (2002) on foraging ecology 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. The study concluded that Indiana bats more frequently used 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).

During Brack and Brown's (2002) survey, a total of 26 roost trees were identified for 8 of 17 bats fitted with transmitters. Of the 26 roost trees, 39% were shagbark hickories (*Carya ovata*) and 12 % northern red oak (*Quercus rubra*). Other tree species used as roosts included white oak (*Quercus alba*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), black oak (*Quercus velutina*), bitternut hickory (*Carya cordiformis*), American basswood (*Tilia americana*), and yellow birch (*Betula alleghaniensis*). Five (19%) of the roost trees were dead snags. All roost trees were located in close proximity to the cave entrance ranging from 0.16 to 0.86 miles, with an average distance of 3,280 feet (0.6 miles). All roost trees 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. Five of the eight bats used the same roost tree for two to three consecutive days. Roosts were located in all types of deciduous forests, but exhibited a disproportional small use of mixed evergreen and deciduous forests. Roosts trees were very exposed with little or no canopy. It is likely that the bats were taking advantage of exposure to solar radiation in order to better regulate body temperature. Many open-canopy areas existed due to recent logging activity that left scattered trees within the harvested areas. Roosts in closed canopy deciduous forests were often in small openings near open corridor flyways.

While much of the activity observed by Brack and Brown (2002) was close to the cave (within approximately 0.6 mile), bats also left the 2-mile study area all together. Males more so than females tended to range further from the cave. Perhaps they would leave to forage where there

was less competition for prey (the caves in the area serve as hibernacula for over 8,000 individual bats of at least five different species) and return to the cave area periodically to mate. It is likely that roosting and foraging activity also occurred outside this 2-mile area, however, monitoring was not conducted beyond the two mile radius.

It is not known whether there are any maternity colonies of the Indiana bat on the JNF or elsewhere in Virginia. Limited evidence suggests the presence of maternity colonies in Virginia and West Virginia. A juvenile male was discovered in West Virginia on August 5, 1999 (Kiser et al. 1999). It is not known whether the juvenile bat had immigrated from a distant or resident maternity colony. Similarly, a juvenile male was captured on July 28, 1992 in Cumberland Gap National Historic Park, Lee County, Virginia (Hobson 1993). Based on this limited information, it is reasonable to assume that there may be some maternity roosts in Virginia, but that if present, the maternity colonies are likely to be small and widely dispersed since Virginia is on the periphery of the species range. It is more likely that the majority of this species' habitat in Virginia is occupied by males. Wooded lands closer to hibernacula are more likely to support males in summer than areas farther away, but essentially all of the Jefferson National Forest may provide suitable migratory and summer habitat for both males and females of the species.

It is impossible to quantify the actual number of Indiana bats that forage and roost throughout the summer on the JNF. However, it is reasonable to assume that the percentage of the Indiana bats that forage and roost on the JNF is relatively proportional to the number of Indiana bats known from hibernacula located on or in near proximity to the JNF. Based on the last ten years of survey data collected from the five hibernacula on or near the JNF (Table 2), an average of 443 Indiana bats may forage and roost on the JNF each summer. This is probably an over-estimation of the number of Indiana bats that roost and forage on the JNF since the lands available to these bats include other areas that are predominantly under private ownership. To provide an analysis of the approximate number of Indiana bats that may use the JNF for summer roosting and foraging, the FWS made the following assumptions:

1. Assuming Indiana bat immigration equals emigration in this area, the 10-year average number of Indiana bats (443 from surveys of the five hibernacula on or near the JNF) represents the population that may use the JNF and other nearby lands for summer roosting and foraging. This assumes some of the bats that winter in the hibernacula leave the area altogether, but other bats immigrate into the area from farther away.
2. Indiana bats from these five hibernacula primarily utilize the Appalachian range and that this area can be defined by the following 4th level watersheds: The Middle and Upper New River, North Fork Holston River, Powell River, Upper Clinch River, Upper Cumberland River, Upper James River, and Upper Levisa River. Three watersheds of the JNF (Middle James-Buffalo, Upper Roanoke, and South Fork Holston) are in the Piedmont and Blue Ridge physiographic regions, where it is less likely that Indiana bats may occur.

Based on these assumptions, the estimated 443 Indiana bats that may summer in this area have approximately 6,186,241 acres of land available to them for roosting and foraging. Of this acreage, 611,643 acres (~10%) are owned by the JNF. Assuming Indiana bats were distributed evenly over the land-area defined by the combined 4th level watersheds, an estimated 44 Indiana bats (10% of the Indiana bats that hibernate on or near the JNF) may forage and roost on the

JNF. It is not likely, though, that the bats would be evenly distributed. It is more likely that male bats may be found closer to the hibernacula during all seasons, and that any pregnant females would be found in larger groups in any maternity colonies, which could occur anywhere with suitable habitat on the JNF.

IV. EFFECTS OF THE ACTION

Direct Effects

Direct impacts to the Indiana bat could occur as the JNF continues to implement its forest-wide management activities. Occupied and potential roost trees could be directly affected by vegetation management, (timber sales, prescribed burns, herbicide treatments) firewood and salvage sales, routine maintenance/permitting of small clearings including easements, rights-of-way and reasonable access to privately-owned lands, and road construction. Plan implementation will result in vegetation disturbance and possible impact to occupied (but unknown) maternity and roost trees. Direct impacts to the Indiana bat may result in direct mortality or injury to undetected individuals or small groups of roosting bats during timber harvest, site preparation, or other activities that result in the removal of trees. The likelihood of cutting a tree containing a maternity colony or individual roosting Indiana bat is anticipated to be low, but not discountable, because of the large number of suitable roost trees present on the JNF, the rarity of the species, and the wide dispersal of Indiana bats and maternity colonies throughout the species' range.

Timber Cutting

Direct effects to Indiana bats could result from the harvesting of hardwood and hardwood/pine habitat or other types of tree removal, forcing the bats in a roosting or maternity colony to abandon a traditionally used site. Additional stress would be placed on pregnant females that are already expending energy. Lower reproductive success or lower survival of young could also result with forced abandonment of lactating females. The FS anticipates that annual regeneration harvests will affect approximately 1,830 acres of potential Indiana bat habitat on the JNF. Salvage operations have averaged about 178 acres a year, but not all salvage occurs in habitats suitable for the Indiana bat. Road construction and maintenance is estimated at about 2.4 acres a year. Tree removal from minor special use permits is estimated at 2 acres a year, and for recreational facilities at 18 acres a year.

Personal Firewood Use

The National Forest fuelwood program allows the public to purchase and collect downed or standing/leaning dead trees for personal firewood use. The program is regulated by issuance of an area-specific permit, and collection occurs primarily along roadsides and other specified sites with easy access. Vehicles must remain on open roads and are not allowed to travel through the forest in order to find, cut, and load firewood. This therefore restricts the distance at which most people are willing to cut and haul firewood and results in most firewood being cut within 150 feet of an open road, and limited almost exclusively to level terrain or the uphill side. During 2001 and 2002, the JNF issued 510 and 466 firewood permits, respectively, for an average of 488 permits over the two-year period. Each permit allowed for the collection of 2 cubic feet (CCF) of firewood (2 CCF roughly equals 1.5 cords of firewood). Therefore, 488 permits equal approximately 732 cords of firewood. Based on yield tables from Firewood Volume Tables

(Mize & Prestemon, 1998), a red oak 16" dbh and 60 ft. tall contains approximately 0.50 cords of firewood, while a white oak the same diameter and height contains approximately 0.54 cords. Therefore, the 732 cords of firewood collected as an average during 2001 and 2002 equals approximately 1,464 dead trees (in this case red oak 16" dbh, 60 ft. tall).

The approximate number of standing dead trees on the JNF can be calculated based on the data collected during the 1991 Forest Inventory and Analysis conducted by the Southern Forest Research Station, Asheville, NC. (More recent data have been collected, but 1991 is the last year Forestwide data are available for analysis.) The number of dead standing trees in 1991 was 15.4 per acre with an average dbh of 9.0". Given that the JNF is approximately 723,000 acres, this equates to at least 11,134,200 snags. The northern portions of the JNF (Glenwood and New Castle Ranger Districts) have been infested with gypsy moths, and pine bark beetle infestations are now Forestwide. Oak and pine tree mortality in the overstory is extensive as a result of these insect infestations. Based on 1991 Forestwide data, personal firewood collection represents approximately 0.0135% of the total available snags. Since most snags are not close to roads or are in Management Prescriptions where firewood cutting is not allowed, the possibility of harming an Indiana bat is remote. In addition to snags, roosting Indiana bats also use live trees. Brack and Brown (2002) reported 81% of roost sites used by radio tagged Indiana bats were live trees. Assuming this trend represented Indiana bat roost selection throughout the JNF, personal firewood collection could affect 0.0027% of the potential Indiana bat roost sites. Although risk of "take" resulting from firewood cutting cannot be completely eliminated, the risk of direct effects to roosts in the vicinity of hibernacula is further minimized since the collection of firewood in primary and secondary cave protection areas is not allowed by prescription standard.

Impacts to Hibernacula

Direct effects to the Indiana bat could also result from human activity (disturbance and vandalism) during the winter in caves containing hibernating Indiana bats. Bat disturbance may cause a bat's fat reserves to become exhausted prior to spring, increasing the potential for mortality. In addition, direct mortality, due to humans killing Indiana bats in caves, has been documented (Mohr 1972). However, the potential of Indiana bats to be disturbed during hibernation on JNF has been greatly reduced or entirely eliminated with the construction of gates at both known hibernacula on the JNF, and the limitation of any human recreational use to the period of June 1 to September 1, which is controlled by the Forest Service.

Prescribed Burning

Over the past several years, the JNF has steadily increased its prescribed burn program. The JNF currently burns approximately 2,500 acres per year under prescribed conditions. The FS anticipates this to increase to as much as 11,000 to 15,000 acres of prescribed burning per year on the JNF. Most of these burns will occur during the spring and early summer with some during the late winter and early fall. Due to this increase in prescribed burning, incidental take of the Indiana bat could increase. Prescribed burning during the summer season could result in direct mortality or injury to the Indiana bat caused by burning or smoke inhalation, especially death to young bats that are not able to fly. Prescribed burns could consume standing snags, thus removing potential roost trees. Living trees suitable as roosts could potentially be killed from the heat/flames from prescribed fire. While this may remove potential live roost trees, it is also likely that the fire will increase the availability of snags. Snags could be created either directly

by fire mortality or indirectly by making them more susceptible to insect attacks or pathogens (Bull *et al.* 1997). Depending on the tree species, live trees subsequently killed by fire activity would remain as suitable potential roost trees until such a time that peeling/lost bark renders them unsuitable as summer roost sites.

Summary of Direct Effects

The FS anticipates that up to 16,800 acres (2.4% of the total forested JNF) of Indiana bat habitat may be disturbed annually on the JNF as a result of timber sales, road construction, prescribed burning, control line construction, development and maintenance of recreational areas, special uses, etc. Implementation of the Revised JLRMP conservation measures (Appendix B) will minimize direct adverse effects to the Indiana bat by maintaining suitable Indiana bat roosting and foraging habitat and protecting Indiana bats from the potential effects of timber harvest and other activities. Because Indiana bats gather near hibernacula in late summer and autumn to swarm and forage, and because these bats require trees suitable for roosting during the daylight hours near each site, the JNF prohibits any logging or road construction within an approximate ½ mile radius of any hibernacula. With the additional 1.5 mile secondary buffer, the total protective buffer around the hibernacula is approximately 2.0 miles. These protective areas are based on the average foraging area seen by Kiser et al. (1996), who found Indiana bats in Kentucky foraging between 1.5 and 2.5 miles from the hibernaculum during the fall. Recent work in Missouri (Romme et. al. 2002) and Kentucky (Kiser and Elliott 1996, Gumbert 1996) have found that Indiana bats range up to 5 miles from hibernacula during autumn and spring swarming activity periods. However, these studies were conducted in areas of rolling lower elevation topography, areas that are quite different than the ridge and valley topography of western Virginia (mountainous with vertical relief 1,300 to 2,500 feet). It is likely that Indiana bat swarming activity in the JNF is confined to the valley in which the hibernacula occurs and may extend into adjacent valleys via gaps in the surrounding ridges or mountains. Telemetry data from Virginia reported by Brack et al. (2002) suggests that the great majority of Indiana bat swarming activity occurs within 2 miles of the hibernaculum in the ridge and valley type topography. Consequently, the 2 mile protective radius around hibernacula on and near the JNF is sufficient to maintain the structural integrity of the cave system, adjoining landscapes, and provide protection for the fall swarming and foraging area, and corridors to both upland forest and riparian areas.

If maternity and roost sites are identified (to date, no maternity sites have been identified in Virginia or the JNF), a radius of approximately 2 miles and ¼ mile, respectively, around each site will be protected. The selection of 2 miles was based on the work of Gardner et al. (1991b) and Garner and Gardner (1992) who found that pregnant, lactating or post-lactating females will travel up to 1.9 miles from their roost trees to forage. In addition, LaVal et al. (1977) and LaVal and LaVal (1980) found that females traveled up to 1.5 miles from their roosts to reach foraging areas nearer to perennial streams. As roost trees are identified, a ¼ mile buffer around the roost tree will result in no logging, road construction, or pesticide use. Therefore, implementation of the above JNF conservation measures will minimize disturbances that could result in the potential taking of Indiana bats within these buffers.

Quantifying incidental take to the Indiana bat from activities on the JNF that result from harassment, injury or death is difficult. As discussed in the *Status of the Species in the Action*

Area, the FWS estimates that 10% or approximately 44 of the Indiana bats that use the five hibernacula on or within proximity to the JNF may occur on the National Forest at any one time. This estimate is based on the proportion of land owned by the JNF (10%) within the watersheds surrounding these hibernacula. However, with such limited information on the actual distribution and total numbers of Indiana bats that summer in Virginia and the surrounding areas of West Virginia and Kentucky, deriving such a number is based on best professional judgment.

Assuming that the Indiana bats that forage and roost on the JNF during the summer are evenly distributed and the number is proportional to the number of Indiana bats in hibernacula near or on the JNF, each bat would occupy 1,590 acres of JNF. If this were the scenario, 10 Indiana bats would be affected annually by the disturbance of 16,800 acres of JNF. However, the distribution of Indiana bats is not likely to be evenly distributed over the landscape. Males may sometimes be found proportionally closer to hibernacula during the summer. Indiana bats, especially pregnant females, tend to roost in colonies. Hobson and Holland (1995) observed up to 10 Indiana bats occupying a shagbark hickory tree on the Warm Spring Ranger District of the George Washington National Forest in Bath County, Virginia. Since the FS has implemented measures to protect foraging and roosting habitat within 2 miles of the known hibernacula, it is less likely that Indiana bats will be injured or killed within that zone. No maternity colonies or individual roost trees have been located on the JNF but likely occur at some low incidence over the 723,300 acres. A worse case scenario would be that one tree annually containing Indiana bats may be cut, burned, or disturbed to the point of harassing, injuring or killing the bats. Using Hobson and Holland's (1995) study as a basis for deriving a number, up to 10 Indiana bats may be impacted annually by FS activities on the JNF.

Although some direct mortality or injury to Indiana bats is anticipated as a result of tree cutting or prescribed burning, many bats are likely to survive such disturbance since the adults may be able to fly away. Belwood (2002) reported a maternity colony in Warren County, Ohio, where 6 dead bats (1 adult and 5 juveniles) were found out of 38 observed Indiana bats (5 adults and 33 juveniles) as a result of the felling of a maternity tree. After fleeing the tree, mother bats apparently returned to the site to retrieve their young. The survival and exact number of bats affected by this incident are not known; however, the finding suggests that Indiana bats have some degree of resilience to direct impacts. If it is assumed that this maternity colony included at least one mother for each juvenile (mothers only produce one juvenile per year), then at least 66 bats occupied the colony. Assuming observed mortality accurately represented actual mortality, then approximately 9% of the bats at the maternity colony were killed. However, it is reasonable to assume unobserved mortality occurred in this incident, especially to the juveniles that may have been abandoned and not observed or that died later as a result of exposure, injury, and/or starvation. Given the limited data on direct effects to Indiana bats, it is our professional judgment that less than 100 % of Indiana bats subject to disturbance will be injured or killed, but we cannot quantify that percentage with present information. Without a basis to predict an exact number, the FWS will use its best professional judgment to assume that up to 10 Indiana bats may be incidentally taken annually from activities on the JNF.

Indirect Effects

Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). Removal of living trees or snags that

have the potential to serve as roosts for maternity colonies or individual bats, or reduction of density of mature trees and overstory canopy could result in the loss or alteration of the summer (roosting and foraging) and pre-hibernation (fall foraging) habitat. In addition, timber harvest could alter insect species composition and may reduce the availability of insects on which bats feed, thereby causing the bats to search for alternate foraging habitat.

Indirect effects to the Indiana bat due to herbicides are considered minimal since herbicides are infrequently used and integrated pest management (which targets the specific pest organisms) is the course of action typically followed. Direct application of herbicides to individual stumps, basal stem treatment, hack and squirt, and cut surface treatments are the usual methods of application. Because these methods target individual stems (versus general broadcast spraying), direct application of these chemicals to bats is not likely. Situations where broadcast application of herbicides are used include conversion of cool season grass fields to warm season grasses and roadside vegetation control. In these situations, although considered temporary, herbicide treatment may cause a short term indirect effect to the Indiana bat by reducing the amount of vegetation, and perhaps a reduction of insect populations, after treatment of an area.

Implementation of the Revised JLRMP conservation standards (Appendix B) will minimize indirect effects on the Indiana bat. Some activities that have associated negative impacts may also have commensurate beneficial effects. Potential habitat (mature forests with trees having exfoliating bark) exists across the entire JNF and contains tree species of the size and type known to be used by the Indiana bat. The retention of snags, trees with exfoliated bark, and hollow trees (as available) will allow for potential Indiana bat roost sites. Management practices that create small forest openings may foster the development of suitable roosting and foraging habitat (Krusic and Neefus 1996). Activities that involve tree removal, which could adversely affect roosting habitat, may at the same time improve foraging and/or roosting habitat conditions by opening the canopy and exposing potential roost trees to a greater amount of sunlight. Romme et al. (1995) reported that stands with closed canopy conditions (>80% canopy closure) provide less than optimal roosting habitat conditions. Selective timber harvesting that reduces canopy closure levels to <80% may enhance Indiana bat roosting habitat. Callahan (1993) stated that manmade disturbances unintentionally made nine trees suitable for Indiana bat maternity roosts. These were in areas that had been heavily logged within the past 20 years and had been used as a hog lot in recent years. Callahan also stated "those activities probably benefited Indiana bats by removing most of the canopy cover and leaving behind many standing dead trees." Gardner et al. (1991b) found that the selective harvesting of living trees did not directly alter summer roosting habitat. The development of infrequently used or closed logging roads and small wildlife openings may improve foraging habitat conditions by providing narrow foraging corridors within a larger network of mature closed canopy forest.

Most types of timber harvest activities (salvage, even-aged, uneven-aged, etc.) would require minimum snag and potential roost tree retention plus specific retention of leave trees such as shagbark hickories, as indicated in Appendix B. In stand regeneration treatments greater than ten acres in size, a minimum average basal area of 15 square feet per acre of live trees is retained throughout the rotation, and priority is given to retaining the largest available trees that exhibit characteristics favored by roosting Indiana bats (sloughing bark, cracks and crevices).

The JNF conservation measures for forest-wide conditions require that timber activities within hardwood dominated forests will leave all shagbark hickory trees (6" dbh) and a minimum number of snags or cavity trees (9" dbh) as potential roost sites except where they pose a safety hazard. The retention of these hickory trees and snags or cavity trees in relatively open habitat provide Indiana bats with good numbers of roost sites that resemble those studied by Callahan (1993) in Missouri and Kurta et al. (1993b) in Michigan. Literature summarized by Romme et al. (1995) shows the smallest roost trees where female Indiana bats have been found were in the range of 9" dhb.

In order to ensure a continuous supply of adequate roost trees, the conservation measures also require the following: a minimum of 60% of the acreage of all CISC Forest Types be maintained at 70 years of age or older; and a minimum of 40% of the acreage of CISC Forest Types 53 (white oak, northern red oak, hickory) and 56 (yellow poplar, white oak, northern red oak) on the JNF be maintained at an age greater than 80 years old. The protection for the two CISC Forest Types 53/56 was based on several components. First, these two Forest Types include shagbark hickory, white oak, and red oak as species components, each being Class I trees, which commonly occur across the JNF. In addition, the majority of known roost sites (shagbark hickory) identified in Virginia (Hobson and Holland 1995, Brack and Brown 2002) have been within an 80+ year old white-oak-red oak-hickory stand. The bat's selection of this forest type and age class prompted the FS to promote and manage these forest types in a mature condition. This age class has a high probability of containing large snags and cavity trees for roosting. Of the total JNF forested acreage (approximately 704,300 acres out of 723,300 acres total for the JNF), approximately 49% (346,500 acres) are in the 53/56 forest types. Of the total acreage of the 53/56 forest types, approximately 50% (172,700 acres) is currently >80 years old.

Acknowledging that stand age and dbh are two features that influence habitat structure, and that these parameters are easily measured at sites proposed for management, secondary cave protection areas are maintained using either of two following criteria:

> A minimum of 60% of the acreage of all Forest Types are maintained over 70 years of age; and a minimum of 40% acreage of CISC Forest Types 53 (white oak, red oak, hickory) and 56 (yellow poplar, white oak, red oak) are maintained at an age greater than 80 years old;
>
> OR
>
> When the above age criteria cannot be met, forest stands receiving even-aged regeneration harvesting are maintained with a minimum of 20 trees per acre in the 10-16 inch dbh class and 15 trees per acre in the greater than 16 inch dbh class, of which two trees per acre must be 20 inches dbh or greater.

The protection and promotion of mature upland forests was based on findings of conducted research (LaVal et al. 1977; LaVal and LaVal 1980; Garner and Gardner 1992; Hobson 1993, Romme et al. 1995). The foraging area selected by individual bats in studies conducted in Virginia (Hobson and Holland 1995, Brack and Brown 2002) have been comprised of mature forest of 70+ years with a closed canopy. Of the total forested acreage unsuitable for timber harvest (436,300 acres), approximately 74% (322,900 acres) are greater than 70 years old.

Approximately 65% (174,200 acres) of the harvestable timber is considered greater than 70 years old. For all forest types on the Forest, 78% (552,608 acres) are greater than 70 years old.

The retention of a minimum of 35 trees per acre, each of which is 10" dbh or greater is based on the knowledge that preferred roost sites are in trees that are 9" dbh or larger. Since most maternity trees that have been discovered to date have been 16" dbh or larger (Gardner et al. 1991, Callahan 1993, Hobson and Holland 1995, Romme et al. 1995, Kurta et al. 1996), the JNF determined that it would be preferable if some of the residual trees per acre be comprised of this size.

Based upon the evidence of overlapping foraging areas (Garner and Gardner 1992), and the occurrence of over 322,900 acres of forest >70 years old, the FWS believes that implementation of the JLRMP conservation measures will provide adequate foraging and roosting habitat for the maintenance and promotion of Indiana bats. Studies in other states have identified Indiana bats utilizing a variety of habitat types from open fields to mature forests. This trend is further supported by the findings of Brack and Brown (2002) during a telemetry study conducted in Bland County, Virginia. According to the 2002-2003 winter survey, Indiana bat numbers are increasing slightly over the past 15 years in hibernacula on and near the JNF (R. Reynolds, VDGIF, pers. comm. 2003). This may be an indication of adequate foraging, roosting, and possibly maternity sites in the area with the increase due to lessened human disturbance in hibernacula.

The use of early successional habitat for foraging has been documented by several authors (LaVal et al. 1977; Gardner et al. 1991b; Garner and Gardner 1992) and is considered a legitimate habitat need. Romme et al. (1995) identified essential summer habitat as including 30%+ forested cover on a landscape scale. The Revised JLRMP conservation measures provide for more than twice the forested area (at least 60% of the JNF be maintained in a mature forest condition) recommended by Romme et al. (1995). Data from a study of habitat usage by bats in Virginia showed more summer foraging activity in regeneration areas than in pole timber, small saw timber, or large saw timber forest stands (Nutt 2001).

Prescribed fire may also improve Indiana bat foraging and roosting habitat by creating a mosaic of early to late successional forest stages. Prescribed burning most often results in some degree of midstory mortality to small-diameter trees and shrubs, producing more open understory conditions. Opening of the midstory may improve foraging and roosting habitat conditions. Individual mortality to trees would increase the number of snags and create scattered canopy gaps, which would improve roosting. Increased insect populations produced in burned areas for foraging is also likely to occur in successional years.

Proposed riparian prescriptions in the Revised JLRMP will further protect riparian areas, an important drinking water source and foraging area for Indiana bats. There are approximately 73,600 acres (10% of the JNF land base) of riparian areas associated with 1,053 miles of perennial streams and 1,970 miles of intermittent streams located throughout the JNF. There are also approximately 348 acres of lakes, ponds, and reservoirs and at least 335 small ponds scattered across the JNF. The FWS believes these provide adequate Indiana bat drinking water sources throughout the Forest.

V. CUMULATIVE EFFECTS

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

American Electric Power (AEP) has proposed a 90-mile long, 765 kV electric transmission line on a 200-foot wide right of way, connecting AEP's Wyoming station, located in Wyoming County, West Virginia, with its Jackson Ferry station, located in Wythe County, Virginia. The Forest Service served as the lead Federal action agency for the various Federal permits associated with this transmission line, and issued an environmental impact statement on the project in 2002. The FS issued a special use permit for this project on November 9, 2003. The proposed transmission line would cross 11.3 miles of the Jefferson National Forest, within the action area of this current consultation. The Indiana bat is known to occupy Bane Cave in the Skydusky Hollow Cave system, approximately 1.25 miles from the proposed AEP transmission line right of way in Bland County, Virginia. Direct effects to the Indiana bat from the AEP project have been avoided by precluding any clearing within 0.5 mile of the hibernaculum and by time of year restrictions that preclude clearing and blasting from 0.5 to five miles of the hibernaculum during the period of April 1 through November 15. Activities farther than five miles from the hibernaculum would be precluded during April 15 through September 15, or would only be conducted after mist netting indicated that the Indiana bat was unlikely to be present in the right of way area. Indirect effects to the Indiana bat from the AEP project include the clearing of approximately 1,614 acres of potential habitat within the right of way and for access roads. (Of the 1,614 acres, 271 acres have been permitted for clearing within the Jefferson National Forest.) The 1,614 acres represents 1.1 percent of the 140,898 acres of potential Indiana bat habitat within two miles of the AEP right of way. In its letter of December 18, 2002 to the Forest Service, the FWS concurred that the AEP project was not likely to adversely affect the Indiana bat, given the large amount of habitat in the project area that would remain after project construction, the avoidance of clearing within 0.5 miles of the hibernaculum, and the time of year restrictions on habitat clearing and blasting.

Activities on private land adjacent to and inholdings within the Jefferson NF are expected to continue at rates as they have in the recent past. Small easements are granted for inholdings through special use permits by the FS. Ten to fifteen projects per year are anticipated to occur on the JNF affecting no more than 30 acres of JNF land. This amount of annual disturbance has been factored into the analysis of take.

This biological opinion addresses activities authorized, funded, or carried out on the Jefferson National Forest, which are under the jurisdiction of the U.S. Forest Service. Any future Federal, State, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion will either be carried out by, or will require a permit from, the Forest Service and will require compliance with Section 7 of the ESA. Therefore, cumulative effects, as defined by the ESA, will be analyzed under future consultations between the Forest Service and the Fish and Wildlife Service for any activities within the Jefferson National Forest.

VI. CONCLUSION

Regulations implementing Section 7(a)(2) of the ESA (50 CFR 402) require the FWS to formulate its biological opinion as to whether a Federal action that is the subject of consultation, taken together with cumulative effects, is likely to jeopardize the continued existence of listed species or the adverse modification of critical habitat. "Jeopardize the continued existence of" is defined by this regulation as, "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." "Destruction or adverse modification" of critical habitat is defined as, "a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical."

In reaching a decision of whether the continued implementation of activities outlined in the JLRMP is or is not likely to jeopardize the continued existence of the Indiana bat, the FWS must factor into its analysis previous biological opinions and any incidental take permits issued to private individuals pursuant to Section 10 of the ESA involving the species. Although a few previously issued biological opinions involve the loss of riparian corridors or foraging and roosting habitat for the Indiana bat, most involve large scale activities implemented under Land Resource Management Plans on National Forests in the Eastern United States. Such opinions involve the potential impact to the largest acreage of Indiana bat roosting and foraging habitat. All previously issued Service biological opinions involving the Indiana bat have been nonjeopardy. The opinions with the largest amount of incidental take were to the U.S. Forest Service for the Cherokee, Daniel Boone, Ozark and St. Francis, Nantahala and Pisgah, Mark Twain, Alleghany, Ouachita, and George Washington and Jefferson National Forests, as shown in Table 3. There has been one Section 10 incidental take permit issued to date, for the Six Points Road Interchange and Associated Development Project, in which the FWS anticipated the incidental take of 344 acres of Indiana bat habitat, which would be a one time permanent impact.

Table 3. Annual Anticipated Incidental Take as Identified in Biological Opinions Previously Issued by the FWS Involving National Forests in the Eastern United States.

Forest	Annual Anticipated Incidental Take (Acres)	Estimated Number of Indiana Bats Potentially Affected
Alleghany	13,984[1]	~400
Cherokee	1,300	~200[2]
Daniel Boone	4,500	~1,600[2]
Mark Twain	38,375	~500
Ozark and St. Francis	19,000[3]	~1,000
Ouachita	43,000	~9
Nantahala and Pisgah	10,772	~25
George Washington & Jefferson	4500	~10
Totals	135,434	~3,744

[1] Five-year average.
[2] MacGregor, personal communication, 1999 as cited in USFWS 2000.
[3] Includes hardwoods, pines, and pine/hardwoods, all of which provide suitable roosting habitat for the Indiana bat.

The cumulative impacts of an annual anticipated incidental take of 135,434 acres on these eight National Forests and the one time loss of 344 acres from the Section 10 permit, and the potential impact to the Indiana bat were evaluated within the context of: (1) the large amount of remaining surrounding landscape that provides suitable foraging and roosting habitat for the species, (2) the conservation measures incorporated into a particular management plan to minimize the impact of tree and habitat removal, (3) the terms and conditions associated with the reasonable and prudent measures provided by the FWS in its nonjeopardy biological opinions for each National Forest that minimize the impact of incidental take, and (4) the percentage of the rangewide population that is predicted to be impacted by the proposed actions. While it is doubtful that the level of incidental take of individual Indiana bats has reached the anticipated number of 3,744 per year, if such a level was reached, it would constitute about 1 percent of the known population of the species. The FWS believes that this amount of incidental take does not rise to the level of effect that would significantly reduce the reproduction, overall population, or distribution of the Indiana bat.

After reviewing the current rangewide status of the Indiana bat, the environmental baseline for the action area, the effects of forest management and other activities on the JNF as described in the 2003 Revised Land and Resource Management Plan, and the cumulative effects, it is the FWS's biological opinion that implementation of forest management and other activities as specified in the Jefferson Land and Resource Management Plan are not likely to jeopardize the continued existence of the Indiana bat. Critical habitat for this species has been designated in Kentucky, Tennessee, Illinois, Indiana, Missouri, and West Virginia. However, this action does not affect those areas and no destruction or adverse modification of that critical habitat will occur as a result of JNF management activities.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the U.S. Forest Service (FS) and become binding conditions of any permit, contract, or grant issued by the FS in order for the exemption of Section 7(o)(2) to apply. The Forest Service has a continuing duty to regulate the activity covered by this incidental take statement. The protective coverage of Section 7(o)(2) may lapse if the Forest Service (1) fails to assume and implement the terms and conditions

of the incidental take statement, and/or (2) fails to require any permittee, contractor, or grantee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, permit or grant document. In order to monitor the impact of incidental take, the Forest Service must report the progress of the action and its impact to the FWS as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

AMOUNT OR EXTENT OF INCIDENTAL TAKE ANTICIPATED

This incidental take statement anticipates the taking of Indiana bats from habitat manipulation activities (e.g., timber sales, road construction, prescribed burning, control line construction, development and maintenance of recreational areas, special uses, etc.) on up to 16,800 acres per year on the JNF. The incidental take of individual Indiana bats as a result of forest management activities or other actions implemented on the JNF will be difficult to quantify and detect due to: 1) the bat's small body size, 2) formation of small (i.e., 25 or fewer to 100 individuals), widely dispersed colonies under loose bark or in cavities of trees, and 3) unknown aerial extent and density of the species summer roosting populations range within JNF.

Incidental take of Indiana bats is expected to be in the form of killing, harming, or harassing. Cutting trees during the non-hibernation season for harvest or other activities may result in injury or mortality to females and young, or to individually roosting male Indiana bats, if a particular tree that is cut contains a maternity colony or roosting bats. If the bats are not killed, the colony or roosting individuals will be forced to find an alternate roost or may be forced to abandon a roost in the area, possibly leading to lower reproduction or survival. Clearing an area may also result in alteration of feeding activities by the bats (i.e., the bats may have to fly farther to forage, or they may be forced to abandon the area altogether). Prescribed burns may result in burning of occupied roost trees, and the smoke and fire generated during prescribed burns could cause roosting bats injury or death. Burning may cause a maternity colony or individual roosting bat to abandon a traditionally used roost site.

Determining the amount of take of individual bats within an expansive area of forested habitat such as the 723,300 Jefferson National Forest is a complex and difficult task. Unless every individual tree that exhibits characteristics for suitable roosting habitat is inspected by a knowledgeable biologist before habitat disturbance begins, it is impossible to know if a maternity colony or roosting Indiana bat(s) is present in an area. It is also impossible to evaluate the amount of incidental take of Indiana bats unless a post-disturbance inspection is immediately made of every tree that has been cut or disturbed. Inspecting individual trees is not considered by the FWS to be a reasonable monitoring method and is not recommended as a means to determine incidental take. The FWS believes if a maternity colony or roosting individuals are present in an area proposed for timber harvest or other disturbance, loss of such suitable habitat could result in incidental take of Indiana bats. Therefore, the level of take of this species can be indirectly anticipated by the areal extent of potential roosting and foraging habitat affected.

Disturbance of Indiana bat habitat on the JNF, excluding prescribed burning, is anticipated to impact approximately 1,800 acres per year. Prescribed fire is estimated to affect up to 15,000 acres of potential Indiana bat habitat per year. The combined activities are expected to result in an annual removal of or disturbance to up to 16,800 acres of potential Indiana bat habitat (2.4% of the total forested JNF land base). However, the consequent taking of Indiana bats is significantly reduced through implementation of the protective standards found in Appendix B of

this Biological Opinion. We also recognize that prescribed burning may improve habitat for the Indiana bat on the JNF by creating additional roost trees and open understory. While the FWS believes that the JNF has taken a significant number of measures to greatly reduce impacts to the Indiana bat, we cannot rule out injury or mortality to the species completely. Based on our analysis of the effects of the action in Section IV of this Biological Opinion, the FWS believes that it is reasonable to estimate that there may be up to 10 Indiana bats on the JNF incidentally taken on an annual basis through actions that kill, harm, or harass.

EFFECT OF THE TAKE

In the accompanying biological opinion, the FWS determined that this level of anticipated take is not likely to result in jeopardy to the Indiana bat or destruction or adverse modification of critical habitat. Implementation of the Indiana bat recovery strategies described in the JNF's standards and guidelines of the 2003 Revised JLRMP, and the reasonable and prudent measures (with implementing terms and conditions) presented below should minimize the potential for incidental take of Indiana bats.

REASONABLE AND PRUDENT MEASURES

The U.S. Fish and Wildlife Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the Indiana bat:

1. Proposed land management activities will be planned, evaluated and implemented consistent with measures developed to protect the Indiana bat and maintain, improve, or enhance its habitat. These measures include, but are not limited to, the standards and guidelines developed in the Revised JLRMP, the GWJNF Indiana Bat Recovery Strategy, and terms and conditions outlined in this biological opinion.

2. The JNF will monitor timber sales and other activities to determine if these measures are being implemented and to document the extent of incidental take.

3. The JNF will continue its efforts to determine use of the JNF by Indiana bats during the hibernation, summer roosting, maternity, and pre-hibernation seasons.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the ESA, the U.S. Forest Service (FS) must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline the required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. In order to minimize possible adverse impacts to Indiana bats and promote recovery of this species within the Jefferson National Forest (JNF), the FS will implement the prescriptions and forest-wide standards outlined in Appendix B of this Biological Opinion.

2. The FS will consult with the Fish and Wildlife Service (FWS) on a case by case basis to determine direct, indirect, and cumulative effects on Indiana bats for the following activities:

(a) Large-scale projects and management activities not covered under the JNF Land and Resource Management Plan, including but not limited to utility corridors (such as transmission lines, oil and gas pipelines); transportation projects; mineral, oil and gas exploration and extraction; wind energy projects; water development projects; and pesticide programs (with the exception of non-aerial herbicide programs).

(b) All activities that may affect Indiana bats or their habitat within 2 miles of Indiana bat hibernacula and/or maternity colonies, and within ¼ mile of known individual roost trees, unless covered by the JNF Land and Resource Management Plan standards as defined in Appendix B.

3. The amount of incidental take as measured indirectly by acreage (both total and categorical levels) must be monitored on an annual basis. The FS will report the number of acres disturbed on a fiscal year basis, to include regeneration harvest, salvage, road construction and maintenance, prescribed burns, and other actions such as special use permits and recreational uses, and will report the estimated number of trees removed for personal firewood. This information is to be provided to the FWS no later than March 1 following the end of the previous fiscal year's activities. Monitoring of timber sales, prescribed burning, and the above activities will be implemented as follows:

(a) Project administrators or biologists will conduct and report normal inspections of projects as identified in Table 1 of the Biological Opinion, prescribed burns, and personal firewood programs to ensure that measures defined in these Terms and Conditions have been implemented. Timber sale administrators will conduct normal inspections of all timber sales to administer provisions for protecting residual trees (residual trees are those trees not designated for cutting under provisions of the timber sale contract). Unnecessary damage to residual trees will be documented in sale inspection reports and proper contractual or legal remedies will be taken. The JNF will include this information in their annual monitoring reports to the FWS.

(b) Consultation between the FWS and the FS will occur as needed in order to review and determine any need to modify provisions of the biological opinion, and other issues regarding the Indiana bat.

4. The FS will continue its efforts to determine use of the JNF by Indiana bats during the hibernation, summer roosting/maternity, and pre-hibernation seasons by implementing the following monitoring. Selection of sites for monitoring and research will be left to the discretion of the JNF biologists in consultation with the FWS and/or Virginia Department of Game and Inland Fisheries. The FWS believes that implementation of this term and condition is necessary to evaluate the underlying assumptions made on Indiana bat presence and characterized use on the JNF. Implementation of this term and condition will, in turn, provide a more site-specific measure of the protective adequacy of the conservation measures for the Indiana bat on the JNF.

a. Continue JLRMP monitoring by working with the FWS, universities, the Virginia Department of Game and Inland Fisheries, the Virginia Department of Conservation and Recreation, and local experts to locate and survey caves and mines that may contain Indiana bats. Surveys of all known Indiana bat hibernacula shall continue every two

years following the protocol of the Indiana Bat Recovery Team. After any new gating of a hibernaculum, yearly surveys shall be conducted to determine the effects of the gates on all bat species. This effort will be conducted for the first three years after gating and then continue with biennial monitoring according to the Indiana bat Recovery Team protocol.

b. Continue monitoring efforts to refine the distribution and abundance of the Indiana bat on the JNF. Survey efforts shall be focused on those areas which, based on habitat characteristics (e.g., percent canopy closure, presence of suitable roost trees, proximity to water, etc.) and/or previous survey results, appear to be conducive to maternity colonies. These surveys shall be designed to determine the distribution of the species on the JNF and its habitat use and movements during the spring through fall periods. If any Indiana bats are captured during mist net surveys, the FWS and the Virginia Department of Game and Inland Fisheries must be notified within 24 hours. The habitat at identified maternity sites will be characterized and quantified, and these habitat data will then be used to assist in identifying additional sites. Information gained during these studies can be used to refine FS strategies for the protection and management of the species.

c Habitat at all sites where Indiana bats are documented on the JNF shall be characterized and quantified at both local and landscape levels.

d. The FS shall provide the results of these surveys to the FWS within 6 months of completion.

5. Care must be taken in handling dead specimens of listed species that are found in the project area to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the FWS to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead, injured, or sick specimen of an endangered or threatened species, initial notification must be made to the U.S. Fish and Wildlife Service at the telephone number and address provided below.

6. The Forest Service shall provide all required monitoring reports and any other additional information to the FWS at the following addresses:

Southwestern Virginia Field Office
U.S. Fish and Wildlife Service
330 Cummings Street
Abingdon, Virginia 24210
Phone: (276) 623-1233
Fax: (276) 623-1185

Virginia Field Office
U.S. Fish and Wildlife Service
6669 Short Lane

Gloucester, Virginia 23061
Phone: (804) 693-6694
Fax: (804) 693-9032

The FWS believes that no more than 16,800 acres (15,000 acres prescribed burning and 1,800 all other disturbances) annually of potential Indiana bat habitat will be disturbed as a result of the proposed action, and that no more than 10 Indiana bats may be incidentally taken on an annual basis on the Jefferson National Forest. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed actions. If, during the course of the action, this level of incidental take is exceeded, as measured by the total amount of habitat disturbance or the location of injured or dead Indiana bats, such incidental take represents new information requiring review of the reasonable and prudent measures. The U.S. Forest Service must immediately provide an explanation of the causes of the take, and review with the FWS the need for possible modification of the reasonable and prudent measures and the terms and conditions.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The FWS believes this provision of the ESA places an obligation on all Federal agencies to implement positive programs to benefit listed species, and a number of recent court cases appear to support that belief. Agencies have some discretion in choosing conservation activities, but Section 7(a)(1) places a mandate on agencies to implement some type of conservation program.

The FWS recommends that the FS implement the following conservation actions for the benefit of the Indiana bat:

1 The protection of Rocky Hollow Cave through conservation easement or acquisition is recommended and should be given a high priority. This is one of the largest known historic hibernacula in Virginia and is located adjacent to JNF lands.

2. It is recommended that the FS give high priority to the protection of inholdings and lands near primary cave protection areas through conservation easements or acquisition.

3. It is recommended the FS pursue the purchase of mineral rights to the area surrounding Kelly Cave.

4. Comparative evaluations of the effectiveness of mist-netting surveys and Anabat detectors are strongly encouraged. We recommend tracking studies using radio-telemetry to identify and characterize roost trees and foraging habitat.

5. Where appropriate, FS biologists should conduct training for employees regarding bats in the National Forests. Training should include sections on bat identification, biology, habitat requirements, and sampling techniques.

6. Approximately 20 million people visit the JNF annually. Therefore, informational/ educational displays regarding all bats occurring on the JNF are strongly encouraged. The FWS believes that such information is important in informing the public about the value of this misunderstood group of mammals.

In order for the FWS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on land and resource management and other actions conducted on the Jefferson National Forest. This biological opinion will remain in effect for the duration of the current JLRMP and will constitute compliance with the ESA's section 7 consultation requirements for future actions covered by the JLRMP, provided that those actions are carried out in compliance with all of the requirements contained in this biological opinion, or until one or more of the following conditions arise. As provided in 50 CFR Sec. 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

The FWS appreciates this opportunity to work with the U.S. Forest Service in fulfilling our mutual responsibilities under the ESA. Please contact Shane Hanlon of the Southwestern Virginia Field office at (276) 623-1233, extension 25 if you have any questions or require additional information.

Sincerely,

Karen L. Mayne

Karen L. Mayne
Supervisor
Virginia Field Office

LITERATURE CITED

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

Belwood, J.J. 2002. Endangered bats in suburbia: observations and concerns for the future. Pp. 193-198 *in* The Indiana Bat: Biology and Management of an Endangered Species (Kurta, A., and J. Kennedy, eds.). Bat Conservation International, Austin, Texas.

Bowles, J.B. 1981. Ecological studies on the Indiana Bat in Iowa. Central College, Pella, Iowa. 28 pp.

Brack, V., Jr. 1983. The nonhibernating ecology of bats in Indiana with emphasis on endangered Indiana bat, *Myotis sodalis*. Ph.D. dissertation, Purdue University, West Lafayette, Indiana, 280 pp.

Brack, V., and J. Brown. 2002. Autumn 2000 radiotelemetry study of the Indiana bat in Skydusky Hollow, Bland County, Virginia. For Appalachian Power Company, d/b/a American Electric Power, Appendices: Biological Assessment for AEP's 90-mile Wyoming-Jacksons Ferry 765 KV Project. Revised July 2002. 68pp.

Bull, E. L., C. G. Parks, and T. R. Torgenson. 1997. Trees and logs important to wildlife in the interior Columbia River basin. USDA, Forest Service, Gen. Tech Rep., PNW-GTR-391:1-40.

Callahan, E.V., III. 1993. Indiana bat summer habitat requirements. Master of Science thesis, University of Missouri. Columbia, Missouri. 74 pp.

Callahan E.V., III, R. Dabney, and R. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalis*) in Missouri. J. Mamm. 78:818-825.

Clark, D.R., Jr. 1981. Bats and environmental contaminants: a review. USDI Fish and Wildlife Service Special Scientific Report. Wildlife No. 235, 27 pp.

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

Clawson, R.L. 2002. Trends in population size and current status. Pp. 2-8 *in* The Indiana Bat: Biology and Management of an Endangered Species (Kurta, A., and J. Kennedy, eds.). Bat Conservation International, Austin, Texas.

Dalton, V.M. 1987. Distribution, abundance, and status of bats hibernating in caves in Virginia. Virginia J. of Sci. 38(4):369-379.

Gardner, J.E., J.D. Garner, and J.E. Hofmann. 1990. Combined progress reports: 1989 and 1990 investigations of *Myotis sodalis* (Indiana bat) distribution, habitat use, and status in

Illinois. Progress report for the U.S. Dept. of Interior, Fish and Wildlife Service, Twin Cities, Minnesota, 19 pp.

Gardner, J.E., J.D. Garner and J.E. Hofmann. 1991a. Summer roost selection and roosting behavior of *Myotis sodalis* (Indiana bat) in Illinois. Final report. Illinois Natural History Survey, Illinois Department of Conservation. Champlain, Illinois. 56 pp.

Gardner, J.E., J.D. Garner and J.E. Hofmann. 1991b. Summary of *Myotis sodalis* summer habitat studies in Illinois: with recommendations for impact assessment. Special report. Illinois Natural History Survey, Illinois Department of Conservation. Champaign, Illinois. 28 pp.

Garner, J.D. and J.E. Gardner. 1992. Determination of summer distribution and habitat utilization of the Indiana bat (*Myotis sodalis*) in Illinois. Unpubl. Report. Endangered Species Coordinator, Region 3, USFWS, Twin Cities, MN. 28 pp.

Gumbert, M. W. 1996. Seasonal Roost Tree Use by Indiana Bats in Somerset Ranger District of the Daniel Boone National Forest, Kentucky. MS Thesis. Eastern Kentucky University, Richmond, Kentucky.

Gumbert, M.W., J.M. O'Keefe, and J.R. MacGregor. 2002. Roost fidelity in Kentucky. Pp. 143-152 *in* The Indiana bat: biology and management of an endangered species (Kurta, A., and J. Kennedy, eds.). Bat Conservation International, Austin, Texas.

Hall, E.R. 1981. The Mammals of North America. Vol. I. John Wiley and Sons, New York. 690 pp.

Hobson, C.R. 1993. Status, distribution, and summer ecology of bats in western Virginia: A survey for the endangered Indiana bat, *Myotis sodalis*. 1993. Report to Virginia Department of Game and Inland Fisheries Non-game Division, Richmond, VA. 18 pp.

Hobson, C.R. and J.N. Holland. 1995. Post-hibernation and foraging habitat of a male Indiana bat, *Myotis sodalis* (Chiroptera: Vespertillionidae), in western Virginia. Brimleyana 23:95-101.

Holsinger, J.R. 1975. Description of Virginia caves: Virginia Division of Mineral Resources Bulletin 85, 450 pp.

Humphrey, S.R., A.R. Richter and J.B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. J. of Mammal. 58:334-346.

Humphrey, S.R. 1978. Status, winter habitat, and management of the endangered Indiana bat, *Myotis sodalis*. J. Mamm. 58:334-346.

Kiser, J.D. and C.L. Elliott. 1996. Foraging habitat, food habits, and roost tree characteristics of the Indiana bat (*Myotis sodalis*) during autumn in Jackson County, Kentucky.

Unpublished report, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.

Kiser, J.D., C.L. Elliott, and J. MacGregor. 1996. The use of roost trees by Indiana bats, *Myotis sodalis*, during autumn. Presented at the sixth colloquium on the Conservation of Mammals in the Southern and Central United States.

Kiser, J.D., R.R. Kiser, and J.R. MacGregor. 1999. A survey for the federally endangered Indiana bat (*Myotis sodalis*) at a proposed surface mine in Franks Creek, Letcher County, Kentucky. Final report submitted to Cumberland River Coal Company, Appalachia, Virginia.

Krusic, R.A. and C. Neefus. 1996. Habitat associations of bat species in the White Mountains National Forest. Pp.185-198 *in* Bats and Forests Symposium, October 19-21, 1995, Victoria, British Columbia, Canada (R.M.R. Barclay and R.M. Brigham, eds.). Research Branch British Columbia Ministry of Forests, Victoria, British Columbia, Working Paper 23:1-292.

Kurta, A.J., J. Kath, E.L. Smith, R. Foster, M.W. Orick, and R. Ross. 1993a. A maternity roost of the endangered Indiana bat (*Myotis sodalis*) on the northern edge of its range. Am. Midl. Nat. 129:132-138.

Kurta, A., D. King, J.A. Teramino, J.M. Stribley, and K.J. Williams. 1993b. Summer roosts of the endangered Indiana bat (*Myotis sodalis*) on the northern edge of its range. Am. Midl. Nat. 129:132-138.

Kurta, A., K.J. Williams, and R. Mies. 1996. Ecological, behavioral, and thermal observations of a peripheral population of Indiana bats (*Myotis sodalis*). Pp. 102-117 *in* Bats and Forests Symposium (R.M.R. Barclay and R.M. Brigham, eds.). Research Branch, British Columbia Ministry of Forests, Victoria, British Columbia, Canada, Working Paper 23:1-292.

LaVal, R.K., R.L. Clawson, M.L. LaVal and W. Caire. 1977. Foraging behavior and nocturnal activity patterns of Missouri bats, with emphasis on the endangered species *Myotis grisescens* and *Myotis sodalis*. J. Mamm. 58:592-599.

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

MacGregor, J., J. Kiser, and M. Gumbert. 1996. The use of road ruts as bat drinking water sources on the Cumberland Plateau of Eastern Kentucky. Presented at the Sixth Colloquium on the Conservation of Mammals in the Southern and Central United States.

MacGregor J., J. Kiser, M. Gumbert and T. Reed. 1999. Autumn roosting disturbance, prescribed burning, and management in the Daniel Boone National Forest, Kentucky.

Abstract in the Proceedings of the Central Hardwoods Forest Conference, hosted by University of Kentucky, Lexington.

Mayr, E. 1954. Change of genetic environment and evolution. Pp. 157-180 *in* Evolution as a Process (J. Huxley, A.C. Hardy, and E.B. Ford eds.). MacMillan, New York, NY.

Mayr, E. 1963. Animal species and evolution. Belknap Press of Harvard University Press, Cambridge, Massachusetts.

Mayr, E. 1982. Processes of speciation in animals. Pp.1-19 *in* Mechanisms of speciation (C. Barigozzi ed.),. Alan R. Liss, New York, NY.

Menzel, M., J. Menzel, T. Carter, W. Ford, and J. Edwards. 2001. Review of the Forest Habitat Relationships of the Indiana bat (*Myotis sodalis*). GTR NE-284. USDA Forest Service, Northeastern Research Station. Newton Square, PA. 21 pp.

Mize, C.W. and D.R. Prestemon. 1998. Firewood volume tables for red oak and white oak. Forestry extension notes F-338, Iowa State University, Ames, Iowa.

Mohr, C.E. 1972. The status of threatened species of cave-dwelling bats. Bull. Natl. Speleol. Soc. 34:33-37.

Nutt, L.M. 2001. Summer foraging habitat and roost tree characteristics of post-lactating female Indiana bats (*Myotis sodalis*) in Virginia. Unpublished report submitted to the U.S. Forest Service, Virginia Department of Game and Inland Fisheries, and Ferrum College.

Richter, A.R., S.R. Humphrey, J.B. Cope and V. Brack, Jr. 1993. Modified cave entrances: thermal effect on body mass and resulting decline of endangered Indiana bats (*Myotis sodalis*). Conserv. Biol. 7:407-415.

Romme, R.C., K. Tyrell and V. Brack, Jr. 1995. Literature summary and habitat suitability index model: components of summer habitat for the Indiana bat, *Myotis sodalis*. Report submitted to the Indiana Department of Natural Resources, Division of Wildlife, Bloomington, Indiana by 3D/Environmental, Cincinnati, Ohio, 43 pp.

Tuttle, M.D. and D.E. Stevenson. 1978. Variation in the cave environment and its biological implications. Pp. 108-121 *in* 1977 National Cave Management Symposium Proceedings (R. Zuber, J. Chester, S. Gilbert, and D. Rhodes, eds.), Adobe Press, Albuquerque, New Mexico. 140 pp.

Tuttle, M.D. and J. Kennedy. 2002. Thermal requirements during hibernation. Pp. 68-78 *in* The Indiana Bat: Biology and Management of an Endangered Species (Kurta, A., and J. Kennedy, eds.). Bat Conservation International, Austin, Texas.

U.S. Forest Service. 1997. Indiana bat (*Myotis sodalis*) recovery strategy for the George Washington and Jefferson National Forests, Roanoke, Virginia, 26 pp.

U.S. Fish and Wildlife Service. 1983. Recovery plan for the Indiana bat. Twin Cities, Minnesota, 23 pp.

U.S. Fish and Wildlife Service. 1996. Draft revised recovery plan for the Indiana bat. Region 3, Ft. Snelling, Minnesota, 60 pp.

U.S. Fish and Wildlife Service. 1999. Agency Draft Indiana Bat Revised Recovery Plan. Ft. Snelling, MN. Draft dated March 1999.

U.S. Fish and Wildlife Service. 2000. Biological Opinion: Biological Assessment on the effect of implementing the Nantahala and Pisgah National Forests Land and Resources Management Plan, Amendment Five, on the Indiana Bat (*Myotis sodalis*). Atlanta Georgia. April 7, 2000. 95 pp.

Wenger, S. 1999. A review of the scientific literature on riparian buffer width, extent and vegetation. Office of Public Service and Outreach, Institute of Ecology, University of Georgia, Athens, Georgia, 59 pp.

Appendix A – Consultation History

06/1993	The George Washington and Jefferson National Forest (GWJNF) began working with the U.S. Fish and Wildlife Service (FWS), Virginia Department of Game and Inland Fisheries (VDGIF), and Ferrum College to develop a comprehensive Indiana Bat conservation plan.
1996 - 1997	Discussions were reinitiated between the FWS and GWJNF regarding a programmatic consultation of the GWJNF forest management activities and other actions that alter forest habitats. In addition, the GWJNF was concurrently revising the draft 1993 Indiana Bat Conservation Plan and developing a comprehensive Indiana Bat Recovery Strategy (IBRS).
04/1997	A Biological Assessment was finalized by the Forest Service (FS) on the effects of implementing GWJNF management plans on the Indiana bat.
05/13/1997	A request by the FS for initiation of formal consultation was received by FWS regarding the 1985 Jefferson National Forest Land and Resource Management Plan (JLRMP) and the 1993 George Washington Land and Resource Management Plan (GWLRMP).
9/16/1997	FWS non-jeopardy Biological Opinion on the Indiana bat was sent to FS.
02/11/1999	Letter from the FWS to the FS regarding a typographical error correction to the 9/16/1997 Biological Opinion related to prescribed burning.
10/01/2001	Letter from the FWS to the FS designating the Virginia Field Office and Southwestern Virginia Field Office with lead responsibility for Ecological Services programs in Virginia. This includes ESA section 7 consultation. Prior to this, the Chesapeake Bay Field Office in Annapolis, Maryland had this responsibility.
01/15/2002	The FWS met with the FS in Roanoke, VA to discuss roles and responsibilities for Section 7 consultation.
03/07/2002	Region 8 of the FS in coordination with Region 4 of the FWS established ESA consultation working group leaders and teams.
03/26/2002	Conference call between the FWS and the FS to finalize botany ESA consultation working group sub-team.
03/27/2002	Meeting in Knoxville, TN between the FWS and the FS to clarify ESA consultation working group team objectives and standardize language.
04/03/2002	FWS and FS sign *a Memorandum of Agreement entitled Consultation Agreement, USDA Forest Service, Region 8 and USDI Fish and Wildlife Service, Region 4 and 5 for Southern Appalachian Forest Plan Revisions.*

04/09/2002	FWS and FS conference call regarding aquatic species ESA consultation working group assignments.
04/22/2002	FWS and FS conference call regarding aquatic species ESA consultation working group recommendations to FWS.
12/12/2002	FWS and FS meeting in Roanoke, VA to review the JLRMP consultation process.
01/13/2003	Service received letter from the FS requesting review of a list of 35 species to be included in the LRMP Revision.
01/17/2003	FWS sent letter to the FS responding to the FS species list. The FWS deemed appropriate the list of 35 species and recommended analysis of 2 candidate species and designated critical habitats.
02/10/2003	FWS made a field visit with FS to the Cinch Ranger District (RD) to discuss recent timber harvest practices on JNF lands.
02/11/2003	The FWS hosted a meeting with the FS in Abingdon, VA to review the FS/FWS consultation agreement, the FS's Aquatic Conservation Plan, and a comparison of the Jefferson Land and Resource Management Plan (JLRMP) and existing Conservation Plan.
03/05/2003	The FWS met with FS in Wytheville to continue discussion of the Jefferson NF proposed LRMP, specifically issues regarding personal-use firewood cutting and cable corridor standards.
03/11/2003	FWS participated in a field visit with FS to the Glenwood RD to look at cable logging practices and their impact on channeled intermittent and ephemeral streams to evaluate standards of the JLRMP.
04/23/2003	FWS participated in a field visit with FS to the Clinch RD to look at recent cable logging projects and their impact on perennial streams to evaluate standards of the Jefferson NF proposed LRMP.
04/24/2003	The FWS hosted a meeting with the FS in Abingdon, VA to continue discussion of the Jefferson NF proposed LRMP.
04/28/2003	The FWS participated in a field visit with FS to the New Castle RD to discuss riparian buffer width for channeled intermittent and ephemeral streams and other riparian standards related to the Jefferson NF proposed LRMP.
05/29/2003	The FWS hosted a meeting with the FS in Abingdon, VA to discuss riparian corridor and conservation plan standards related to the Jefferson NF proposed LRMP.

06/17/2003	The FWS hosted a meeting with the FS in Abingdon, VA to continue discussion of the Jefferson NF proposed LRMP.
08/19/2003	The FWS received a letter from the FS requesting formal section 7 consultation and met with the FS in Abingdon, VA to receive and discuss the Biological Assessment for the Jefferson NF LRMP.
09/11/2003	The FWS sent a letter to the FS acknowledging that the FWS had received the FS request for formal section 7 consultation and that the package was complete.
09/2003 - 01/2004	Through telephone, fax, and electronic mail correspondences, FWS obtained additional information and analysis from the FS on the present and projected condition of the JNF and effects of the JLRMP on Indiana bats.

Appendix B – Standards and Conservation Measures Outlined in the 2003 Revised Jefferson Land and Resource Management Plan for the Indiana Bat

Forest-wide Indiana Bat Management

Each Indiana bat hibernaculum has a primary and secondary cave protection area managed according to management prescription 8E4. If additional hibernacula are found, the desired condition and standards of management prescription 8E4 apply until an environmental analysis to consider amendment to the Forest Plan is completed.

- In order to promote potential summer roost trees and maternity sites for the Indiana bat throughout the Forest, planned silvicultural practices in hardwood-dominated forest types will leave all shagbark hickory trees greater than 6 inches d.b.h. and larger, except when they pose a safety hazard. In addition:

  Clearcut openings 10 to 25 acres in size will also retain a minimum average of 6 snags or cavity trees per acre, 9 inches d.b.h. or larger, scattered or clumped.

  Group selection openings and clearcuts less than 10 acres in size have no provision for retention of a minimum number of snags, cavity trees, or residual basal area due the small opening size and safety concerns.

  All other harvesting methods (and clearcut openings 26-40 acres in size) will retain a minimum residual 15 square feet of basal area per acre (including 6 snags or cavity trees) scattered or clumped. Residual trees are greater than 6 inches d.b.h. with priority given to the largest available trees, which exhibit characteristics favored as roost trees by Indiana bats.

  To insure a continuous supply of roost trees and foraging habitat, the following forest-wide conditions must be maintained:

  Minimum of 60% of the combined acreage of all CISC Forest Types on the Forest will be maintained over 70 years of age; AND

  Minimum of 40% of the combined acreage of all CISC Forest Types 53 (white oak, red oak, hickory) and 56 (yellow poplar, white oak, red oak) will be maintained at an age greater than 80 years old.

- When active roost trees are identified on the Forest, they will be protected with a ¼ mile buffer surrounding them. This protective buffer remains until such time the trees and associated area no longer serve as a roost (e.g., loss of exfoliating bark or cavities, blown down, or decay).

- No disturbance that will result in the potential taking of an Indiana bat will occur within this active roost tree buffer.

  Commercial timber harvesting, road construction, and use of the insecticide diflubenzuron are prohibited.

Prescribed burning, timber cutting, road maintenance, and integrated pest management using biological or species-specific controls during non-roosting season are allowed, following project level analysis to determine the direct, indirect, and cumulative effects on Indiana bats and the hibernacula.

Other activities within this buffer are allowed following determination that they will not result in a potential taking of an Indiana bat.

- Removal of known Indiana bat active roost trees will be avoided, except as specified in the next 2 standards.

  If during project implementation, active roost trees are identified, all project activity will cease within a ¼ mile buffer around the roost tree until consultation with U.S. Fish and Wildlife Service is completed to determine whether project activities can resume.

- In the event that it becomes absolutely necessary to remove a known Indiana bat active roost tree, such a removal will be conducted during the time period when the bats are likely to be in hibernation (November 15 through March 31), through informal consultation with the U.S. Fish and Wildlife Service. Trees identified as immediate threats to public safety may be removed when bats are not hibernating; however, informal consultation with U.S. Fish and Wildlife Service is still required. Examples of immediate threats to public safety include trees leaning over a trail, public road or powerline that could fall at any time due to decay or damage.

- Prescribed burning is allowed to maintain flight and foraging corridors in upland and riparian areas potentially used by bats in the summer. To avoid injury to non-flying young Indiana bats, prescribed burning of active maternity roosting sites between June 1 and August 1 is prohibited.

- Opportunities should be sought to include creation of drinking water sources for bats in project plans, where appropriate, in areas where no reliable sources of drinking water are available. Opportunities will be considered when the creation is not detrimental to other wetland-dependent species (I.e., damage to natural springs and seeps).

- If active maternity roost sites are identified on the Forest, they will be protected with a 2-mile buffer defined by the maternity roost, alternate roost sites, and adjacent foraging areas.

- No disturbance that will result in the potential taking of an Indiana bat will occur within this active maternity roost site buffer. Commercial timber harvesting, road construction, and use of all pesticides is prohibited. All other activities within this buffer will be evaluated during project level analysis to determine the direct, indirect, and cumulative effects on Indiana bats, through informal consultation with the U.S. Fish and Wildlife Service.

- If during project implementation, active maternity roost sites are identified, all project activity will cease within a 2-mile buffer around the maternity roost until consultation with U.S. Fish and Wildlife Service is completed to determine whether project activities can resume.

Monitoring of timber sales and other activities will be implemented as follows:

Timber sale administrators or biologists will conduct and report normal inspections of all timber sales to ensure that measures to protect the Indiana bat have been implemented. Timber sale administrators will conduct normal inspections of all timber sales to administer provisions for protecting residual trees not designated for cutting under provisions of the timber sale contract. Unnecessary damage to residual trees will be documented in sale inspection reports and proper contractual or legal remedies will be taken. The Forest will include this information in their annual monitoring reports and made available to the U.S. Fish and Wildlife Service, if requested.

Informal consultations among the U.S. Fish and Wildlife Service and the Forest will occur as needed in order to review and determine any need to modify provisions of the biological opinion, and other issues regarding the Indiana bat.

- Where appropriate, training should be conducted for employees regarding bats in the National Forests. Training should include sections on bat identification, biology, habitat requirements, and sampling techniques.

  Develop informational and educational displays about bats to inform the public about this misunderstood group of mammals.

When not specifically stated otherwise, the following standards refer to both the primary (8E4a) and secondary (8E4b) cave protection areas.

Primary Cave Protection Area

8E4-001 Each Indiana bat hibernaculum will have a primary buffer consisting of a radius of no less than one half mile around each hibernaculum, defined by national forest surface ownership and topography.

8E4-002 No disturbance that will result in the potential taking of an Indiana bat will occur within this buffer.

Commercial timber harvesting, road construction, use of the insecticide diflubenzuron, creation of early successional habitat, expansion or creation of permanent wildlife openings, and mineral exploration and development are prohibited.
Prescribed burning, tree cutting, road maintenance, and integrated pest management using biological or species-specific controls are evaluated during project level analysis to determine the direct, indirect, and cumulative effects on Indiana bats and the hibernacula.

8E4-003 All currently known hibernacula are gated. If additional hibernacula are found, the caves are gated, if necessary, to protect Indiana bats during the critical hibernation period.

8E4-004 All caves may be opened for public use during the summer months for recreational use from June 1 to September 1.

Secondary Cave Protection Area

8E4-005 A secondary buffer consisting of a radius of approximately 1½ miles around each primary cave protection area, defined by easily recognizable features on the ground, will have limited disturbance.

8E4-006 Within the secondary cave protection area, the following management activities can occur following evaluation to determine the direct, indirect, and cumulative effects on Indiana bats and the hibernacula:

- Regeneration timber sales;
  Thinning;
  Road construction or reconstruction;
  Prescribed burning;
- Trail construction or reconstruction;
- Special uses; and
- Biological or species-specific pesticide use.

Active Maternity Site Protection

8E4-007 If active maternity roost sites are identified on the Forest, they are protected with a 2-mile buffer defined by the maternity roost, alternate roost sites, and adjacent foraging areas. See Forestwide standards.

Active Roost Tree Protection

8E4-008 As active roost trees are identified on the Forest, they are protected with a ¼ mile buffer surrounding them. This protective buffer remains until such time they no longer serve as a roost (e.g., loss of exfoliating bark or cavities, blown down, or decay). See Forestwide standards.

Terrestrial and Aquatic Species

8E4-009 Management for other plant and animal species within the primary cave protection areas is evaluated during project level analysis to determine the direct, indirect, and cumulative effects on Indiana bats and the hibernacula.

8E4-010 Opportunities should be sought to include creation of drinking water sources for bats in project plans, where appropriate, in areas where no reliable sources of drinking water are available. Opportunities are considered when the creation is not detrimental to other wetland-dependent species (i.e., damage to natural springs and seeps).

8E4-01 Limit creation of early successional habitat to 10 percent of forested acres in the secondary cave protection area. Creation of early successional habitat in the primary cave protection area is prohibited.

8E4-012 Existing old fields, wildlife openings, and other habitat improvements for fish and wildlife may be present and maintained within both the primary and secondary cave protection areas, but no expansion of openings or creation of new permanent openings of this type occurs within the primary cave protection area. Native species are emphasized when establishing food plants for wildlife. Some openings provide permanent shrub/sapling habitat as a result of longer maintenance cycles.

8E4-013 Structural habitat improvements for fish and other aquatic species are allowed.

Threatened, Endangered and Sensitive Species

8E4-014 Management for other known populations of threatened, endangered, sensitive, and locally rare species within the primary cave protection areas are evaluated during project level analysis to determine the direct, indirect, and cumulative effects on Indiana bats and the hibernacula.

Rare Communities and Old Growth

8E4-015 Maintain rare communities in both the primary and secondary cave protection areas.

8E4-016 Old growth patches of all sizes and community types are maintained and restored.

Vegetation and Forest Health

8E4-017 Allow vegetation management activities within primary cave protection areas to:

- Promote trees that retain slabs of exfoliating bark;
  Promote large diameter roost trees with some daily exposure to sunlight;
  Thin dense midstories that restrict bat movement;
- Improve other threatened, endangered, sensitive, and locally rare species habitat;
- Maintain rare communities and species dependent on disturbance;
  Reduce fuel buildups;
- Restore historic fire regimes, particularly in pine and pine-oak woodlands;
- Reduce insect and disease hazard to oak-hickory forest communities;
- Control non-native invasive vegetation.

8E4-018 Allow vegetation management activities within secondary cave protection areas to:

- Maintain oak-hickory forest communities; and restore pine and pine-oak woodlands;
- Promote trees that retain slabs of exfoliating bark;
- Promote large diameter roost trees with some daily exposure to sunlight;
  Thin dense midstories that restrict bat movement;
  Improve other threatened, endangered, sensitive, and locally rare species habitat;
- Maintain rare communities and species dependent on disturbance;

- Reduce fuel buildups;
- Restore, enhance, or mimic historic fire regimes;
- Reduce insect and disease hazard;
- Control non-native invasive vegetation;
- Salvage dead and dying trees as a result of insects, diseases, or other natural disturbance events;
- Provide up to 10% early successional habitat conditions.

8E4-019 Strive for optimum roosting habitat of 16 or more Class 1 and/or Class 2 trees greater than 9 inches d.b.h. per acre, as averaged across the prescription area associated with each hibernaculum. Class 1 trees are those species which are most likely to have exfoliating bark either in life or after death, and which are most likely to retain it for several years after they die. Class 2 trees characteristically have exfoliating bark as well, but are considered to be of slightly lower quality than Class 1 trees. See Table 3-2.

Table 3-2. Class 1 and 2 Trees

Class 1 Trees	Class 2 Trees
Carya cordiformis (bitternut hickory)	*Acer rubrum* (red maple)
Carya laciniosa (shellbark hickory)	*Acer saccharum* (sugar maple)
Carya ovata (shagbark hickory)	*Aesculus octandra* (yellow buckeye)
Fraxinus Americana (white ash)	*Betula lenta* (sweet birch)
Fraxinus pennsylvanica (green ash)	*Carya glabra* (pignut hickory)
Quercus alba (white oak)	*Carya spp.* (other hickories)
Quercus prinus (chestnut oak)	*Fagus grandifolia* (American beech)
Quercus rubra (red oak)	*Liriodendron tulipifera* (tulip poplar)
Quercus stellata (post oak)	*Nyssa sylvatica* (black gum)
Ulmus rubra (slippery elm)	*Platanus occidentalis* (sycamore)
	Robinia pseudoacacia (black locust)
	Quercus coccinea (scarlet oak)
	Quercus velutina (black oak)
	Sassafras albidum (sassafras)
	Pinus echinata (shortleaf pine)
	Pinus virginiana (Virginia pine)
	Pinus rigida (pitch pine)
	Pinus pungens (table mountain pine)

Timber Management

8E4-020 Primary cave protection areas are unsuitable for timber production. Commercial timber harvest is not allowed.

8E4-021 Secondary cave protection areas are suitable for timber production. The remainder of the standards under this Timber Management section refer only to the secondary cave protection area:

8E4-022 Clearcutting is prohibited.

8E4-023 In order to promote fall foraging and swarming areas, timber activities will leave all shagbark hickory trees and retain a minimum average of 6 snags or cavity trees (greater than or equal to 9 inches d.b.h.) per acre as potential roost sites (except where they pose a safety hazard). For group selection harvest method, all shagbark hickories are maintained (except where they pose a safety hazard) with no provision for minimum number of snags or cavity trees due to the small opening size.

8E4-024 Forested communities are maintained using either of two following criteria:

A minimum of 60% of the acreage of all Forest Types are maintained over 70 years of age; and a minimum of 40% acreage of CISC Forest Types 53 (white oak, red oak, hickory) and 56 (yellow poplar, white oak, red oak) are maintained at an age greater than 80 years old;

OR

When the above age criteria cannot be met, forest stands receiving even-aged regeneration harvesting are maintained with a minimum of 20 trees per acre in the 10-16 inch d.b.h. class and 15 trees per acre in the greater than 16 inch d.b.h. class, of which two trees per acre must be 20 inches d.b.h. or greater.

8E4-025 The 0 - 10 age class will not exceed 10% at any time (regardless which of the criteria above are used).

8E4-026 Timber marking and harvesting crews will receive training in the identification of potentially valuable roost trees.

8E4-027 Timber harvesting operations will be suspended from September 15 until November 15.

Non-timber Forest Products

8E4-029 Do not issue authorizations for the commercial or personal use of any forest products, including firewood.

Prescribed Fire and Wildland Fire Use

8E4-030 Prescribed burning and wildland fire use is allowed to manage vegetation to maintain flight and foraging corridors in upland and riparian areas potentially used by bats in the summer.

Recreation

8E4-031 Maintain trails to the minimum standard necessary for protection of the soil, water, vegetation, visual quality, user safety, and long-term maintenance.

8E4-032 New trail construction is allowed only within the secondary cave protection area.

8E4-033 Licensed OHV use is permitted in this prescription area only on existing open roads.

Scenery

8E4-034 Management activities are designed to meet or exceed the following Scenic Integrity Objectives, which may vary by inventoried Scenic Class:

Inventoried Scenic Class	1	2	3	4	5	6	7
Scenic Integrity Objectives	H	M	M	M	M	M	M

8E4-035 Management activities are designed to meet or exceed a high Scenic Integrity Objective in semi-primitive non-motorized areas within this prescription area.

Range

8E4-036 In order to maintain open woodland and grassland conditions suitable for fall swarming and roosting, livestock grazing is permitted to continue where it currently exists.

Minerals

8E4-037 The primary cave protection areas are administratively unavailable for oil and gas and other Federal leasable minerals. Existing leases are not renewed upon expiration. These areas are not available for mineral materials for commercial, personal, or free use purposes. Administrative use of mineral materials is allowed when: a) the materials are used within the primary cave protection area itself; and b) use is necessary to protect Indiana bat habitat.

8E4-038 Within the secondary cave protection areas, oil and gas are allowed with a timing stipulation to protect Indiana bat habitat from September 15 to November 15. Other Federal minerals are allowed on a case-by-case basis after full consideration of effects on Indiana bat habitat. Permit mineral materials for commercial, personal, free, and administrative use purposes with conditions to protect Indiana bat habitat.

8E4-039 The Kelly Cave area is underlain by private mineral rights. Requests for access to a non-Federal interest in lands pursuant to a reserved or outstanding right are recognized, and reasonable access is granted. Encourage such interests to minimize disturbance to Indiana bat habitat when possible.

Roads

8E4-040 Within the primary cave protection area, do not permit road construction, subject to valid existing rights or leases. Road reconstruction and minor relocation are permitted to benefit the Indiana bat and its habitat.

8E4-041 New construction and reconstruction are allowed in the secondary cave protection area.

8E4-042 Decommission roads when adversely affecting caves, their hydrology, or Indiana bat habitat security.

Lands and Special Uses

8E4-043 The Rocky Hollow Cave (Clinch Ranger District) is given a high priority for acquisition (on a willing seller basis) since it is one of the largest known historic hibernacula in Virginia and is situated adjacent to national forest lands.

8E4-044 Primary cave protection areas are unsuitable for new special uses, except for research and outfitter-guide operations. Phase out existing non-conforming uses.

8E4-045 Allow commercial use by outfitters and guides if compatible with preservation of the primary cave protection areas. Do not allow contest events such as foot races or horseback endurance events. Require outfitters and guides to use leave-no-trace techniques. Do not allow permanent camps.

8E4-046 Within secondary cave protection areas, new special use proposals are analyzed on a case-by-case basis to determine the potential effects on the Indiana bat.