

West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241

Dr. Bov B. Eav
Station Director
U.S. Department of Agriculture
Northeastern Research Station
11 Campus Blvd., Suite 200
Newtown, Square, Pennsylvania 19073

Dear Dr. Eav:

The U.S. Fish and Wildlife Service (Service) has reviewed the project plans and Biological Assessment (BA) for proposed research activities by the U. S. Forest Service (Forest Service) on the Fernow Experimental Forest (FEF) located near Parsons, West Virginia. With a target initiation date of fall 2000, the project will result in 670.62 acres of forest disturbance resulting from silvicultural research treatments, including various harvesting and regeneration cuts and prescribed fire. The proposed project would result in the removal of approximately 2.5 million board feet of timber over the next 5 years. Your letter, dated August 28, 2000 requested we initiate formal consultation pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*). The Service submitted a draft biological opinion (BO) for your review, dated October 23, 2000, on the effects that the proposed activity will have on the federally listed species, the Indiana bat, Myotis sodalis. This document constitutes the Services final BO for the proposed research activities on the FEF for the next 5 years.

The Service concurs with the “not likely to adversely affect” determination for the Virginia big-eared bat, Corynorhinus townsendii virginianus; the West Virginia northern flying squirrel, Glaucomys sabrinus fuscus; and the Cheat Mountain salamander, Plethodon nettingi, therefore, they will not be addressed further in this draft BO. The endangered plant, Running Buffalo clover, Trifolium stoloniferum, also occurs on the FEF, however, it is an integral part of the FEF’s research proposal and will be covered under a Recovery Permit issued by the Service’s Region 5, Office pursuant to Section 10(a)(1)(A) of the ESA. Therefore, running buffalo clover will not be addressed further in this draft BO.

CONSULTATION HISTORY

Big Springs Blowing Cave is an Indiana bat hibernaculum located on the FEF. Winter bat surveys have been conducted there since 1952. The cave was gated by the Forest Service in 1973 to protect the IB hibernaculum from human disturbance. In 1995, in coordination with the Service, the West Virginia

Division of Natural Resources conducted studies to determine summer and fall usage by Indiana bats of the area immediately surrounding Big Springs Cave. Since August 1997, the Service has had numerous meetings, phone conversations and site visits to discuss issues associated with research activities on the FEF and their possible impacts to the Indiana bat. In July 1998, the Service reviewed and concurred with the FEF that their proposed research activities for fiscal years 1999 and 2000 were not likely not adversely affect the Indiana bat. On February 24, 2000 consultation began on FEF's recent proposed research activities for fiscal years 2001 through 2005. As a result of changes in the Service's consultation guidelines for the Indiana bat, on August 28, 2000, the Northeastern Research Station requested the initiation of formal consultation on the FEF's proposed research program for the Indiana bat.

BIOLOGICAL OPINION

Description of the Proposed Action

The FEF is a 4,615 acre experimental forest near Parsons, Tucker County, West Virginia. The FEF is administered by the Northeastern Research Station, Timber and Watershed Lab of the Forest Service. The current mission of the FEF is to explain the role of natural and human-induced factors on the sustainability of central Appalachian forest ecosystems, and to provide guidelines for managing central Appalachian forests for a range of products and benefits while maintaining the productivity and diversity of soil, water, wildlife, and forest resources. The purpose of the proposed projects is to continue important long-term research on the effects of various silvicultural practices on forest productivity, species composition and diversity, wildlife populations, and ecosystem processes. The selected alternative C is comprised of six proposed research activities and additional mitigation activities designed to address issues related to federally listed species, species of concern, sensitive species, and sedimentation. An array of silvicultural treatments, including single-tree selection, diameter-limit, patch clearcut, financial maturity cut, strip-cutting, and burning will result in disturbance to approximately 670.0 acres of forest habitat, with the removal of approximately 2.5 million board feet of timber over the next five years.

General Biology and Life History of the Species

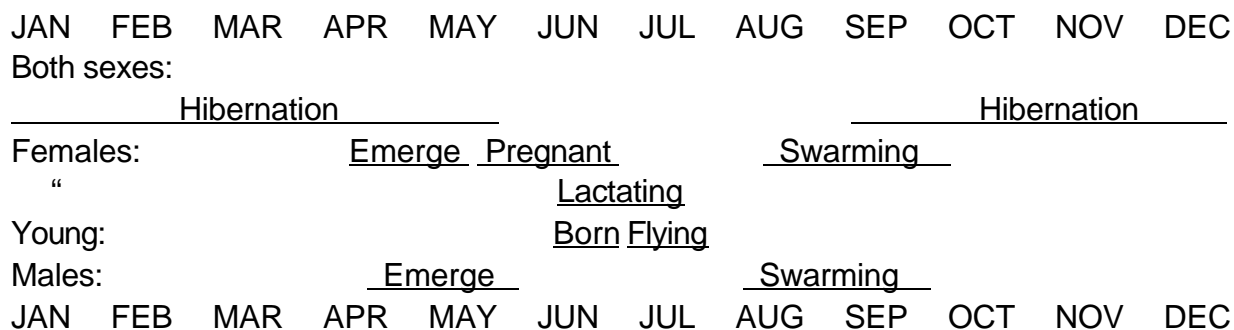
The following is a comprehensive review of the winter, summer, and fall behavior and habitat requirements of the Indiana bat from the Service's Columbia Field Office's June 23, 1999 Biological Opinion for the Indiana bat on the Mark Twain National Forest in Missouri.

1. Behavior. Generally, Indiana bats hibernate from October through April (Hall, 1962; LaVal and LaVal, 1980) (September - May in northern areas [U.S. Fish and Wildlife Service 1999]), depending upon local weather conditions (Figure 1) for a depiction of the annual cycle). They hibernate in large, dense clusters, ranging from 300 bats per square foot (3,230 bats/m²) (Clawson *et al.*, 1980) to 484 bats per square foot (5,215 bats/m²) (Clawson, pers. observ., October 1996). Indiana bats are very loyal to their hibernacula (LaVal and LaVal, 1980).

Upon arrival at hibernating caves in August-September, Indiana bats "swarm," a behavior in which "large numbers of bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in the caves during the day" (Cope and Humphrey, 1977). Swarming continues for several weeks and mating occurs during the latter part of the period. Fat supplies are replenished as the bats forage prior to hibernation. Indiana bats tend to hibernate in the same cave in which they swarm (LaVal *et al.*, 1976; Stihler, pers. observ., October 1996), although swarming has occurred in caves other than those in which the bats hibernated (Cope and Humphrey, 1977; MacGregor, pers. observ., October 1996).

During swarming, males remain active over a longer period of time at cave entrances than do females (LaVal and LaVal, 1980), probably to mate with the females as they arrive. After mating, females enter directly into hibernation. A majority of bats of both sexes hibernate by the end of November (by mid-October in northern areas [Kurta, pers. observ., June 1997]), but hibernacula populations may increase throughout the fall and even into early January (Clawson *et al.*, 1980).

Figure 1. Indiana bat annual chronology (from U.S. Fish and Wildlife Service 1999).



Adult females store sperm through the winter and become pregnant via delayed fertilization soon after emergence from hibernation. Young bats can mate in their first autumn and have offspring the following year, whereas males may not mature until the second year. Limited mating activity occurs throughout the winter and in late April as the bats leave hibernation (Hall, 1962). Females emerge from hibernation ahead of males; most winter populations leave by early May. Some males spend the summer near hibernacula in Missouri (LaVal and LaVal, 1980) and West Virginia (U.S. Fish and Wildlife Service 1999). In spring when fat reserves and food supplies are low, migration is probably hazardous (Tuttle and Stevenson, 1977). Consequently, mortality may be higher in the early spring, immediately following emergence.

Females may arrive in their summer habitats as early as April 15 in Illinois (Gardner *et al.*, 1991a; Brack, 1979). During this early spring period, a number of roosts (e.g., small cavities) may be used temporarily, until a roost with larger numbers of bats is established. Humphrey *et al.* (1977) determined that Indiana bats first arrived at their maternity roost in early May in Indiana, with substantial numbers arriving in mid-May. Parturition occurs in late June and early July (Easterla and Watkins, 1969; Humphrey *et al.*, 1977) and the young are able to fly between mid-July or early August (Mumford and Cope, 1958; Cope *et al.*, 1974; Humphrey *et al.*, 1977; Clark *et al.*, 1987; Gardner *et al.*, 1991a; Kurta *et al.*, 1996).

Most of the documented maternity colonies contained 100 or fewer adult bats. After grouping into nursery colonies, females give birth to a single young in late June or early July. Some males disperse throughout the range and roost individually or in small numbers in the same types of trees and in the same areas as females, while other males remain near their hibernacula. Maternity colonies occupy roost sites in forested riparian, flood plain, or upland habitats, and exhibit strong roost site fidelity (Cope *et al.*, 1978; Clark *et al.*, 1987; Gardner *et al.* 1991a, b; Brack, 1983; Callahan *et al.*, 1977; U.S. Fish and Wildlife Service 1999).

Young Indiana bats are capable of flight within a month of birth. Young born in late June may be flying as early as the first week of July (Clark *et al.*, 1987), others from mid- to late July. Indiana bats spend the latter part of the summer accumulating fat reserves for fall migration and hibernation.

Humphrey and Cope (1977) determined that female survivorship in an Indiana population of Indiana bats was 76% for ages one to six years, and 66% for ages six to 10 years; for males, survivorship was 70% for ages one to six years, and 36% for ages six to 10 years. The maximum ages for banded individuals were 15 years for females and 14 years for males. Mortality between birth and weaning has been estimated at 8% (Humphrey *et al.* 1977).

2. Food habits. Indiana bats feed solely on aquatic and terrestrial, flying insects. They are habitat generalists and their selection of prey items reflects the environment in which they forage (LaVal and LaVal 1980). Diet varies seasonally and variation is observed among different ages, sexes, and reproductive-status groups (Belwood, 1979; Lee, 1993). Reproductively active females and juveniles exhibit greater dietary diversity than males and non-reproductively active adult females, perhaps due to higher energy demands. Reproductively active females eat more aquatic insects than do adult males or juveniles (Lee, 1993).

Moths (Lepidoptera) are major prey items identified in several studies (Belwood, 1979; LaVal and LaVal 1980; Brack and LaVal, 1985; Lee, 1993; Gardner and Virgil Brack (BHE

Environmental, Inc., Cincinnati, Ohio) (unpubl. data), but caddisflies (Trichoptera) and flies (Diptera) are major prey items documented in another (Kurta and Whitaker, 1998). Another major prey group includes mosquitoes and midges (Belwood, 1979; Gardner and Brack, unpubl. data), especially species that form large mating aggregations above or near water (Belwood, 1979). Other prey include bees, wasps, and flying ants (Hymenoptera), beetles (Coleoptera), leafhoppers (Homoptera), treehoppers (Homoptera), stoneflies (Plecoptera), and lacewings (Neuroptera) (Whitaker, 1972; Belwood, 1979; Gardner and Brack, unpubl. data). Male Indiana bats summering in or near a hibernation cave feed preferentially on moths and beetles. Additionally, caddisflies, flies, mosquitoes, midges, stone flies, leafhoppers, treehoppers, and true bugs are consumed, but in low percentages (U.S. Fish and Wildlife Service 1999). LaVal and Brack (1985) examined fecal pellets of 140 male Indiana bats and identified 83% of the prey items as Lepidoptera and 7% as Coleoptera”.

“1. Winter habitat. Indiana bats require specific roost sites in caves or mines (Tuttle and Taylor 1994) that attain appropriate temperatures to hibernate. In southern parts of the bat’s range, hibernacula trap large volumes of cold air and the bats hibernate where resulting rock temperatures drop; in northern parts of the range, however, the bats avoid the coldest sites. In both cases, the bats choose roosts with a low risk of freezing. Ideal sites are 50°F (10°C) or below when the bats arrive in October and November. Early studies identified a preferred mid-winter temperature range of 39-46°F (4-8°C), but a recent examination of long-term data suggests that a slightly lower and narrower range of 37-43°F (3-6 °C) may be ideal for the species (U.S. Fish and Wildlife Service 1999). Only a small percentage of available caves provide for this specialized requirement. 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). Indiana bats will occasionally use sites other than caves or mines if microclimate conditions are favorable. Kurta and Termanio (1994) found a single Indiana bat roosting with a large colony of 15,000 bats (mostly little brown and northern long-eared bats) at a hydroelectric dam in Manistee County, Michigan and noted that the temperature was about 4.7 ° C.

Relative humidity at roost sites during hibernation usually is above 74% but below saturation (Hall, 1962; Humphrey, 1978; LaVal *et al.*, 1976; Kurta and Teramino 1994), although relative humidity as low as 54% has been observed (Myers, 1964). Humidity may be an important factor in successful hibernation (Thomas and Cloutier, 1992).

Specific cave configurations determine temperature and humidity microclimates, and thus suitability for Indiana bats (Tuttle and Stevenson, 1978; LaVal and LaVal, 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 cold air flows and is trapped (Tuttle and Stevenson, 1978; U.S. Fish and Wildlife Service 1999).

Indiana bats often hibernate in the same hibernacula with other species of bats, and are occasionally observed clustered with or adjacent to other species including gray bats (*Myotis grisescens*), Virginia big-eared bats (*Plecotus townsendii virginianus*), little brown bats, and northern long-eared bats (Myers 1964; LaVal and LaVal 1980; Kurta and Teramino 1994).

2. Summer habitat. A full, well-integrated understanding of the summer needs of this endangered species is yet to be attained. Early researchers considered flood plain and riparian forest to be the primary roosting and foraging habitats used in the summer by the Indiana bat (Humphrey *et al.*, 1977), and these forest types unquestionably are important. More recently, upland forest has been shown to be used by Indiana bats for roosting (Clark *et al.*, 1987; Gardner *et al.*, 1991*b*; Callahan *et al.*, 1997; John MacGregor, Daniel Boone National Forest, Kentucky, *in litt.* April 14, 1997); and upland forest, old fields, and pastures with scattered trees have been shown to provide foraging habitat (Gardner *et al.*, 1991*b*; MacGregor, *in litt.* April 14, 1997).

Indiana bats occupy highly altered landscapes in many areas in the eastern United States and use ephemeral, mostly dead and dying trees for roosting. Anecdotal evidence suggests that the Indiana bat may, in fact, respond positively to some degree of habitat disturbance. In northern Missouri, maternity roosts were found in areas that were heavily disturbed (Callahan 1993; Miller 1996). Timber harvest activities neither directly damaged known roosts nor discouraged bats from continuing to forage in an area that had been harvested in Illinois (Gardner *et al.*, 1991*a*), and the species has been found roosting in shelterwood cuts in Kentucky (U.S. Fish and Wildlife Service 1999).

Analysis of landscape changes in Missouri, especially in the Ozarks provides strong, convincing evidence that Indiana bats evolved in an open to semi-open savanna-like environment, at least in the western part of the species' range (Marbut 1914; Sauer 1920; Schroeder 1981; Giessman *et al.* 1986; Ladd 1991; Nigh *et al.* 1992; Jacobson and Primm 1997). This is supported by the analysis conducted of several maternity sites by Romme *et al.* (1995) who found that most roosts were located in areas that had a canopy closure of 60 to 80%. Humphrey *et al.* (1977) hypothesized that roost trees were usually located in openings within the forest because they provided the necessary thermoregulatory characteristics.

Within the range of the species, the existence of Indiana bats in a particular area may be governed by the availability of natural roost structures, primarily standing dead trees with loose bark. The suitability of any tree as a roost site is determined by (1) its condition (dead or alive), (2) the quantity of loose bark, (3) the tree's solar exposure and location in relation to other trees, and (4) the tree's spatial relationship to water sources and foraging areas.

A number of tree species have been reported to be used as roosts by Indiana bats. These

include: American beech (*Fagus grandifolia*), ashes (*Fraxinus* spp.), black gum (*Nyssa sylvatica*), black locust (*Robinia pseudo-acacia*), cottonwood, elms (*Ulmus* spp.), hickories (*Carya* spp.), maples (*Acer* spp.), oaks (*Quercus* spp.), pines (*Pinus* spp.), sassafras (*Sassafras albidum*), sourwood (*Oxydendrum arboreum*), sweet birch (*Betula lenta*), and yellow buckeye (*Aesculus octandra*) (Cope *et al.*, 1974; Humphrey *et al.*, 1977; Gardner *et al.*, 1991a, b; Garner and Gardner 1992; Kurta *et al.*, 1993a; Romme *et al.* 1995; Kiser and Elliott, 1996; Kiser *et al.*, 1996; Kurta *et al.*, 1996; MacGregor, *in litt.*, September 3, 1996; Callahan *et al.*, 1997; MacGregor *in litt.* April 14, 1997). Morphological characteristics of the bark of a number of trees make them suitable as roosts for Indiana bats; that is, when dead, senescent, or severely injured (e.g., lightning-struck) trees possess bark that springs away from the trunk upon drying. Additionally, the shaggy bark of some living hickories (*Carya* spp.) and large white oaks (*Quercus alba*) also provide roost sites. The most important characteristics of trees that provide roosts are not species but structure: exfoliating bark with space for bats to roost between the bark and the bole of the tree. The length of persistence of peeling bark varies with the species of tree and the severity of environmental factors to which it is subjected.

Occasionally, tree cavities or hollow portions of tree boles and limbs provide roost sites for Indiana bats (Gardner *et al.*, 1991a; Kurta *et al.*, 1993b). A crevice in the top of a lightning-struck tree (Gardner *et al.*, 1991a), and splits below splintered, broken tree tops have also been used as roosts (U.S. Fish and Wildlife Service 1999).

Indiana bat maternity colonies use multiple roosts, in both dead and living trees. Exposure of roost trees to sunlight and location relative to other trees are important factors in suitability and use. Because cool temperatures can delay the development of fetal and juvenile young (Racey, 1982), selection of maternity roost sites may be critical to reproductive success. Dead trees with east-southeast and south-southwest exposures may allow solar radiation to effectively warm nursery roosts. Roosts in some species of living trees (e.g., shagbark hickory [*Carya ovata*]), on the other hand, may provide better protection from rain water and other unfavorable environmental conditions. Their greater thermal mass holds more favorable temperatures for roosting bats during cool periods (Humphrey *et al.*, 1977).

Most roost trees used by a maternity colony are close together. The spatial extent and configuration of a colony's regular use area is probably determined by the availability of suitable roosts. The distances between roosts occupied by bats within a single maternity colony have ranged from just a few meters for nearest distance to another roost to several kilometers (km) and, in one case, five km for furthest distance between roosts (Callahan *et al.*, 1997; U.S. Fish and Wildlife Service 1999). Miller (1996) compared habitat variables for sites in northern Missouri where surveys for Indiana bats had been conducted and noted that significantly larger trees [> 30 centimeters (cm) (12 in) diameter breast height (dbh)] were

found where reproductively active Indiana bats had been netted, than at sites at where bats had not been captured.

Indiana bat maternity roosts can be described as "primary" or "alternate" based upon the proportion of bats in a colony occupying the roost site, and location in relation to forest canopy cover (Callahan *et al.*, 1997; Kurta *et al.*, 1996). Maternity colonies have at least one primary roost (up to three have been identified for a single colony) that is used by the majority of the bats throughout the summer. Colonies also use multiple alternate roosts that are used by small numbers of bats intermittently throughout the summer (U.S. Fish and Wildlife Service 1999). Kurta *et al.* (1996) studied a maternity colony in northern Michigan over a three-year period and noted that roosting bats changed roost trees every 2.9 days and that the number of roosts used by the colony ranged from five to 18.

Primary roosts are located in openings or at the edge of forest stands, while alternate roosts can be in either the open or the interior of forest stands. Thermoregulatory needs may be a factor in roost site selection. Primary roosts are not surrounded by closed canopy and can be warmed by solar radiation, thus providing a favorable microclimate for growth and development of young during normal weather. Alternate roosts tend to be more shaded, frequently are within forest stands, and are selected when temperatures are above normal or during periods of precipitation. Shagbark hickories seem to be particularly good alternate roosts because they provide cooler roost conditions during periods of high heat and their tight bark shields bats from the encroachment of water into the roost during rain events (Callahan *et al.*, 1997). Roost site selection and use may differ between northern and southern parts of the species' range, but to date, such analyses have not been undertaken.

Because roost trees used by Indiana bat roosts are ephemeral, it is not possible to generalize or estimate roost longevity due to the many factors that influence it. Bark may slough off completely or the tree may fall over. Although roosts may only be habitable for one to two years under "natural conditions" for some tree species (Humphrey *et al.* 1977), others with good bark retention such as slippery elm, cottonwood, green ash (*Fraxinus pennsylvanica*), and oaks, may provide roosting habitat four to eight years (Gardner *et al.*, 1991a; Callahan *et al.*, 1997; U.S. Fish and Wildlife Service 1999). Hickories also retain bark well.

Indiana bats exhibit varying degrees of site fidelity to summer colony areas, roosts, and foraging habitat. Females have been documented returning to the same roosts from one year to the next (Humphrey *et al.*, 1977; Gardner *et al.*, 1991a,b; Callahan *et al.*, 1997). Kurta *et al.* (1996), however, noted that individuals in a maternity colony in northern Michigan "were not highly faithful to a particular tree." In Illinois, male Indiana bats exhibited some site fidelity to summering areas that they had occupied during previous years (Gardner *et al.*, 1991b).

The Indiana bat may be more adaptable with regard to roosts than previously believed. Humphrey *et al.* (1977) suggested that previously used summer roosts may be important to the reproductive success of local Indiana bat populations; that if these roosts are lost or unavailable, adult females may be faced with finding suitable maternity sites at a time when they are already stressed from post-hibernation migration and the increased metabolic energy costs of pregnancy. Others, (e.g., Kurta *et al.* 1996) however, have more recently noted that Indiana bats will use multiple roost sites within a maternity colony area. Bats move from one roost to another within a season, in addition to responding to changes in environmental conditions (temperature and precipitation), and when a particular roost becomes unavailable (Gardner *et al.*, 1991a; Callahan *et al.*, 1997). Thus, the species appears to be an adaptable animal that takes advantage of the ephemeral habitat available to it. Nonetheless, it is apparent that a variety of suitable roosts within a colony's occupied summer range should be available to assure the continuance of the colony in that area (Kurta *et al.*, 1993a; Callahan *et al.*, 1997).

3. Fall and spring roosts. Indiana bats use roosts in the spring and fall similar to those selected during the summer. During the fall, when Indiana bats swarm and mate at their hibernacula, male bats roost in trees nearby during the day and fly to the cave during the night. In Kentucky, Kiser and Elliott (1996) found male Indiana bats roosting primarily in dead trees on upper slopes and ridgetops within 1.5 mi (2.4 km) of their hibernaculum. During September in West Virginia, male Indiana bats roosted within 3.5 miles (mi) (5.6 km) in trees near ridgetops, and often switched roost trees from day to day (U.S. Fish and Wildlife Service 1999). Fall roost trees more often tend to be exposed to sunshine rather than being shaded (U.S. Fish and Wildlife Service 1999).

Upon emergence from hibernation in the spring, some males remain within the vicinity of their hibernacula, where they roost and forage in mature forest; movements of 2.5 - 10 mi (4 - 16 km) have been reported in Kentucky, Missouri, and Virginia respectively (MacGregor, pers. commun., December 1998; Hobson and Holland, 1995; 3D/International, 1996). However, other males leave the area entirely upon emergence in the spring. Females dispersing from a Kentucky hibernaculum in the spring moved 4- 10 mi (6.4- 16 km) within 10 days of emergence (MacGregor, pers. commun., December 1998).

4. Foraging habitat and behavior. Indiana bats forage in and around tree canopy of flood plain, riparian, and upland forest. In riparian areas, Indiana bats primarily forage around and near riparian and flood plain trees (e.g., sycamore [*Platanus occidentalis*], cottonwood, black walnut [*Juglans nigra*], black willow [*Salix nigra*], and oaks), and solitary trees and forest edge on the flood plain (Belwood, 1979; Cope *et al.*, 1974; Humphrey *et al.*, 1977; Clark *et al.*, 1987; Gardner *et al.*, 1991b). Within flood plain forests where Indiana bats forage, canopy closures range from 30 to 100% (Gardner *et al.*, 1991b). Cope *et al.* (1978) characterized woody vegetation with a width of at least 30 yards (~ 30 m) on both sides of a stream as

excellent foraging habitat. Streams, associated flood plain forests, and impounded bodies of water (e.g., ponds, wetlands, reservoirs) are preferred foraging habitats for pregnant and lactating Indiana bats, some of which may fly up to 1½ mi (2.5 km) from upland roosts (Gardner *et al.*, 1991*b*). Indiana bats also forage within the canopy of upland forests, over clearings with early successional vegetation (e.g., old fields), along the borders of croplands, along wooded fencerows, and over farm ponds in pastures (Clark *et al.*, 1987; Gardner *et al.*, 1991*b*).

The extent of foraging area used by an Indiana bat maternity colony has been reported to range from a linear strip of creek vegetation 0.5 mi (0.8 km) in length (Belwood, 1979; Cope *et al.*, 1974; Humphrey *et al.*, 1977), to a foraging area 0.75 mi (1.2 km) in length, within which bats flew over the wooded river or around the riverside trees (Cope *et al.*, 1978). Indiana bats return nightly to their foraging areas (Gardner *et al.*, 1991*b*).

Indiana bats usually forage and fly within an air space from 6 - 100 ft (2 - 30 m) above ground level (Humphrey *et al.*, 1977). Most Indiana bats caught in mist nets are captured over streams and other flyways at heights greater than 6 ft (2 m) (Gardner *et al.*, 1989).

During summer, male Indiana bats that remained near their Missouri hibernacula flew cross-country or upstream toward narrower, more densely wooded riparian areas during nightly foraging bouts, perhaps due to interspecific competition with gray bats (*M. grisescens*). Some male bats also foraged at the edges of small flood plain pastures, within dense forest, and on hillsides and ridgetops; maximum reported distance was 1.2 mi (2 km) (LaVal *et al.*, 1976; LaVal *et al.* 1977; LaVal and LaVal, 1980; MacGregor,). In Kentucky, MacGregor (pers. commun., December 1998) reported that the maximum distance males moved from their hibernaculum in the summer was about 2.6 mi (4.2 km). In the fall, male Indiana bats tend to roost and forage in upland and ridgetop forests, but also may forage in valley and riparian forest; movements of 1.8 - 4.2 mi (2.5 - 6.8 km) have been reported in Kentucky and Missouri (Kiser and Elliott, 1996; 3D/International, 1996; MacGregor, *in litt.* June 1997).

Review of Endangered Species Information

The Indiana bat was listed as an endangered species on March 11, 1967. The Indiana bat is a migratory species ranging throughout much of the eastern half of the U.S. During winter, Indiana bats are restricted to suitable hibernacula, mainly caves, throughout the karst regions of the east-central U.S. More than 85% of the range wide population occupies nine Priority One hibernacula (hibernation sites with a recorded population greater than 30,000) in Indiana, Kentucky, and Missouri. Priority Two hibernacula (hibernation sites with a recorded population greater than 500 but less than 30,000) are known from the aforementioned states, in addition to Arkansas, Illinois, New York, Ohio, Tennessee, Virginia, and West Virginia. Hellhole

in Pendleton County, West Virginia, is a Priority Two cave with a winter (1999) population of approximately 9,000 bats. Hellhole is officially designated Critical Habitat by the Service.

Priority Three hibernacula (less than 500) are known from 17 states. The limestone region of West Virginia in Preston, Tucker, Randolph, Pendleton, Pocahontas, Greenbrier, Monroe and Mercer Counties have approximately 28 hibernacula ranging from one to 9,000 Indiana bats.

In the spring, Indiana bats emerge from their hibernacula and utilize cavities, splits or the loose or exfoliated bark of live or dead trees for roosting. No female Indiana bats have been captured in West Virginia before August 15 outside of the swarming habitat in proximity to the hibernacula. However, one immature male Indiana bat was captured near Richwood in Nicholas County before August 15, suggesting that it may have been born in West Virginia. Several males have been captured or observed in the vicinity of the hibernacula in the summer, but only two males have been captured away from the swarming areas. These include the aforementioned immature male near Richwood and an adult male in the Lilly Fork Watershed of Clay County. To date the evidence is inconclusive as to whether female Indiana bats migrate from their hibernacula and utilize any part of West Virginia to bear and rear their offspring.

Reasons for Decline and Continued Threats

At the present time, the Indiana bat is in sharp decline throughout its range. The reason for the current rate of decline is not known, however, several known human-related factors of the past are probably not responsible. However, based on hibernacula counts, the West Virginia population has increased significantly, more than doubling since about 1980 (USFWS, 1999).

A major cause of Indiana bat decline in the past has been human disturbance during hibernation. Bats enter hibernation with only enough fat reserves to last until spring. If bats are aroused during hibernation, stored fat reserves are used. If disturbance is too frequent fat reserves may be exhausted before the bats are able to forage in the spring and stress or starvation may occur. Indiana bats are more prone to disturbance than most species of bats due to their behavior of forming large clusters during hibernation. Vandalism in the past has also been a factor. Other factors responsible for Indiana bat declines include: improperly constructed gates modifying cave microclimate, natural hazards resulting in drowning or freezing, destruction of maternity habitat, and chemical contamination (USFWS, 1999).

Environmental Baseline

The FEF is located within a five-mile radius of two Indiana bat hibernacula, Big Springs Blowing Cave and Two Lick Cave. Big Springs Blowing Cave is located on the FEF and during the winter of 1998/1999, 210 Indiana bats hibernated in the cave. Two Lick Cave, located to the south of the FEF on the Monongahela National Forest, had a small hibernating population in the winter of 1999/2000 of only three Indiana bats. The FEF is located just outside of the 5 mile radius to the southwest of the Cave

Hollow/Arbogast Cave system. Cave Hollow/Arbogast Cave system had a hibernating population of 124 Indiana bats in the winter of 1998/1999 (Stihler, pers. comm., 2000). Despite a vigorous mist netting effort covering most of West Virginia and especially in the vicinity of the Monongahela National Forest over the last four years, no female Indiana bats have been discovered in West Virginia between May 15 and August 15. This suggests that if reproduction/maternity use is occurring it is doing so at an extremely low, non-detectable level. A WVDNR study conducted in 1995 found that male Indiana bats stay in the vicinity of Big Springs Blowing Cave during the summer and fall, and that females, returning from their maternity areas (presently unknown), joined the males after August 15. It was concluded that the FEF was not being used as a maternity area. A total of 1,054 bats of nine species were captured in the vicinity of Big Springs Blowing Cave. A total of 69 Indiana bats were captured during the study, of which five were females. In addition, the WVDNR conducted a telemetry study of four male Indiana bats on the FEF in 1997. Both living and dead trees were selected by the Indiana bats for day roosting. These included northern red oak, red maple, black cherry, yellow poplar, shagbark hickory, white ash, and slippery elm.

Effects of the Action

Approximately 670.0 acres of the FEF are proposed to undergo a variety of silvicultural treatments over the next 5 years. Tree removal during the non-hibernation period (April 1 - November 14) may result in mortality (take) of an individual roosting Indiana bat, if a tree is removed intentionally or felled accidentally that contains a roosting bat. If a bat using a roost tree that is removed is not killed during the removal, the roosting bat would be forced to find an alternative tree, potentially expending a significant amount of energy that would result in harm or harassment of the individual. This also constitutes take. Prescribed burning may result in burning of occupied roost trees outside of the hibernation period (November 15 - March 31). Smoke generated during prescribed burns could also cause roosting bats harm or death. Burning may cause an individual roosting bat to abandon a traditionally used roost tree.

However, implementation of the terms and conditions associated with the reasonable and prudent measures provided below by the Service, 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 prescribed burning.

Conclusion

After reviewing the current status of the Indiana bat, the environmental baseline of the action area, and the effects of the selected alternative C, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Indiana bat. Critical habitat has been designated for this species, however none will be affected by this action.

Incidental Take Statement

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act, prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Forest Service so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, 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. If the Forest Service (1) fails to assume and implement the terms and conditions, or (2) fails to require an applicant to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may

lapse. In order to monitor the impact of incidental take, the Forest Service must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement [50 CFR § 402.14(i)(3)].

Level of Take

The Service anticipates that incidental take of Indiana bats as a result of the Forest Service's research activities implemented on the FEF will be difficult to quantify and detect due to the bat's small body size, widely dispersed individuals under loose bark or in cavities of trees, and unknown areal extent and density of their summer roosting populations range within the FEF. However, any incidental take of Indiana bats is expected to be in the form of killing, harming, or harassing. Tree removal during the non-hibernation season may result in mortality to individually roosting Indiana bats. Prescribed burning may result in burning of occupied roost trees outside of the hibernation period (November 15 - March 31). Smoke generated during prescribed burns could also cause roosting bats discomfort or death. Burning may cause an individual roosting bat to abandon a traditionally used roost tree.

Monitoring to determine take of individual bats within an expansive area of forested habitat is a complex and difficult task. Unless every individual tree that contains suitable roosting habitat is inspected by a knowledgeable biologist before management activities begin, it would be impossible to know if a roosting Indiana bat is present in an area proposed for harvest. It would also be impossible to evaluate the amount of incidental take of Indiana bats unless a post-harvest inspection is immediately made of every tree that has been removed or disturbed. Inspecting individual trees is not considered by the Service to be a practical survey method and is not recommended as a means to determine incidental take. However, the areal extent of potential roosting habitat affected can be used as a surrogate to monitor the level of take. Although, to the best of our knowledge, no individually roosting Indiana bats have been incidentally taken to date on the FEF during tree removal or other habitat modifying activities, the possible removal of undiscovered occupied roost tree(s) may result in incidental take of this species. The Service believes that if roosting individuals are present in an area proposed for timber harvest or other disturbance, loss of suitable roosting habitat could result in incidental take of Indiana bats. However, implementation of the terms and conditions associated with the reasonable and prudent measures provided below by the Service, will significantly reduce the potential of incidental take.

This incidental take statement anticipates the taking of a presently unquantifiable number of Indiana bats from timber harvest, road construction and prescribed burning occurring only during the non-hibernation season April 1 - November 15 on the FEF. Each year during this period, approximately 42 acres (36 percent of the actual annual harvest of 115 acres) of suitable Indiana bat habitat are affected by timber harvest and road construction activities that might result in direct take of Indiana bats. In addition, 95 acres of prescribed burning in late winter or spring on 18 acres in 2001 and 77 acres in 2002 may affect an unquantifiable number of Indiana bats. The prescribed burning is proposed to occur between January 1 and May 31, of 2001 and 2002, respectively. However, depending on climatic conditions, all or a portion of the proposed prescribed burning may occur outside of the hibernation period, or possibly be postponed to other years within the 5-year research period. Therefore, the incidental take statement is based on the timber harvest and road construction activities occurring on a maximum of 42 acres annually and prescribed burning on a maximum of 18 acres in 2001 and 77 acres in 2002, unless unsuitable burning conditions necessitated postponement to other years.

Since the level of incidental take of Indiana bats cannot be adequately determined, incidental take will be anticipated by the loss or abandonment of roost trees occupied by Indiana bats that are contained within the 42 acres annually harvested and the 18 acres and 77 acres of prescribed burning planned in 2001 and 2002, respectively, outside of the hibernation period. However, implementation of the terms and conditions associated with the reasonable and prudent measures will reduce the impact of the potential for incidental take. Research or other activities on the FEF that would increase the number of acres harvested or otherwise affected by tree removal or burning during the non-hibernation season would be considered to affect this determination and would require reinitiation of formal consultation.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to further minimize impacts of incidental take of Indiana bats on the FEF.

1. Proposed research activities shall be planned, evaluated, and implemented consistent with measures developed to protect the Indiana bat and reduce adverse impacts from the removal of potentially occupied roost trees and prescribed burns.
2. The Forest Service shall monitor the status of the Indiana bat on FEF, especially during the non-hibernating season.
3. The Forest Service shall monitor timber harvest and other activities on the FEF to determine whether mitigation measures to protect threatened, endangered and sensitive species, and the terms and conditions of the BO are being implemented.

Terms and Conditions

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

1. Retain all shagbark hickory trees on the FEF.
2. Protect all known roost trees on the FEF until such time as they no longer serve as roost trees (e.g., loss of exfoliating bark or cavities, blown down or decay).
3. Conduct timber harvest in mesic, cooler habitats on the FEF during the non-hibernation period as proposed.
4. Conduct timber harvest and road construction activities on the FEF between October 1 and April 30 each year, as proposed.
5. Conduct prescribed burning activities on the FEF between January 1 and May 31 in 2001 and 2002 as proposed, unless unsuitable burning conditions necessitate postponement to subsequent years.
6. Establish stream side management zones along perennial and non-perennial streams to protect streams and their riparian areas on the FEF, as proposed.
7. Monitor Indiana bat activity using Anabat detectors on selected treatment areas on the FEF to determine the Indiana bat reaction/ use before, during, and after timber harvest. The monitoring plan shall

be coordinated and approved by the Service and the WVDNR.

8. Monitor Indiana bat activity using Anabat detectors in the spring and fall at Big Springs Blowing Cave to determine dates of emergence and hibernation in correlation with weather conditions.
9. The number of acres of trees harvested and acres burned during the non-hibernation season must be monitored on an annual basis. This information shall be provided to the Service no later than December 31 following that year's activities.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act 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.

1. Develop an outreach program specifically directed towards eastern woodland bat species and their conservation needs. The program would target federal, state, and private foresters and land managers. In order for the Service to be kept informed of action minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

Reinitiation of Formal Consultation

This concludes formal consultation on the action outlined in Alternative C. As required by 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such a take must cease, pending reinitiation.

The Service appreciates the opportunity to work with the Forest Service in fulfilling our mutual responsibilities under the Endangered Species Act. If you have any questions, please contact Endangered Species Specialist, Mr. William Tolin or myself at (304) 636-6586, or at the letterhead address.

Sincerely,

Jeffrey K. Towner
Field Supervisor

Literature Cited

U.S. Fish and Wildlife Service. 1999. Agency draft Indiana Bat (*Myotis sodalis*) revised recovery plan. 53pp.

U.S. Fish and Wildlife Service. 1999. Biological opinion on the impacts of forest management and other activities to the gray bat, bald eagle, Indiana bat, and Mead's milkweed on the Mark Twain National Forest Missouri. Region 3, Columbia Field Office. 101pp

cc:

Fernow Experimental Forest - Adams

WVDNR - Stihler

PAFO - Densmore

Monongahela SO - Myers

Readers file

Project file

ES:WVFO:Tolin:skd

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