REVISED BIOLOGICAL ASSESSMENT
FOR
THREATENED AND ENDANGERED SPECIES
ON THE
MONONGAHELA NATIONAL FOREST
WEST VIRGINIA

September 2001

USDA Forest Service
Eastern Region
Milwaukee, WI

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EXECUTIVE SUMMARY

This Programmatic Biological Assessment (BA) documents potential effects of continued implementation of the 1986 (as amended) Monongahela National Forest Land and Resource Management Plan (hereafter called the Forest Plan) on nine federally listed threatened and endangered (T&E) species that occur on the Monongahela National Forest (MNF). Those species are: Bald Eagle (*Haliaeetus leucocephalus*), Cheat Mountain Salamander (*Plethodon nettingi nettingi*), Indiana Bat (*Myotis sodalis*), Virginia Big-Eared Bat (*Corynorhinus townsendii virginianus*), West Virginia Northern Flying Squirrel (*Glaucomys sabrinus fuscus*), Shale Barren Rock Cress (*Arabis serotina*), Virginia Spirea (*Spiraea virginiana*), Running Buffalo Clover (*Trifolium stoloniferum*), and the Small-Whorled Pogonia (*Isotria medeoloides*).

Federal agencies are required to comply with provisions of the Endangered Species Act (ESA) of 1973, as amended. This includes a requirement to consult with the US Fish and Wildlife Service on projects that may affect species federally listed as threatened or endangered (TE).

This BA is intended to ensure that management decisions can be made with the most current and state-of-the science information concerning these species. The BA will provide a basis for additional consultation with the USFWS, subsequent Forest Plan amendments if needed, and input into future management decisions on the MNF.

The primary focus for this programmatic BA is to document the effects of current and projected management activities on the MNF and determine if additional conservation measures are needed in order to comply with requirements of ESA, and to move listed species toward recovery. Information from past and current research, combined with additional local survey data is refining our knowledge of habitat requirements for these species and their current status on the MNF.

An additional focus for this BA is to review information acquired since 1986 to determine whether adjustments to the existing Forest Plan standards and guidelines may be necessary for protection and management of these species on the MNF.

DETERMINATIONS

The following determinations of effects to Threatened and Endangered species have been made as a result of this Biological Assessment:

Bald Eagle (Haliaeetus leucocephalus)

A **MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT** determination is made for regeneration harvesting, thinning and single tree selection, prescribed fire, road construction/reconstruction, recreation, wildlife and fisheries habitat improvement, and mineral activity. A **NO EFFECT** determination is made for TSI, firewood cutting, gypsy moth, and range.

Cheat Mountain Salamander (Plethodon nettingi nettingi)

MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for regeneration harvesting, thinning and single tree selection, timber stand improvement, firewood cutting, road construction/reconstruction, recreation, wildlife and fisheries habitat improvements, and mineral activity based on the continuing practice of avoiding lands containing occupied CMS habitat or high potential habitat in any project design. Therefore, potential effects of these activities will not be realized in areas where CMS occur. A NO EFFECT determination is made for prescribed fire, gypsy moth, and range.

Indiana Bat (Myotis sodalis)

A **MAY AFFECT, LIKELY TO ADVERSELY AFFECT** determination is made for all activities that involve tree cutting (regeneration harvest, thinning and single tree selection, timber stand improvement, road construction/reconstruction, recreation, prescribed fire, wildlife habitat improvement, fisheries improvement, and mineral activity) that occur outside of the 5 mile zones.

The chances of harming an IB during MNF tree cutting activities or prescribed fire in the general forest area is relatively small, but it is not discountable, due to the fact that there is possible evidence of nearby maternity activities, the ability of this mobile species to move into "cleared" project areas, and the lack of sufficient knowledge of this species. This is true for all habitats and seasons that IB may be using the MNF except for hibernation. During summer extensive (and continuing) survey data indicate IB numbers across the MNF are extremely small relative to available acres or project acres. Within the 5-mile zones, effects are discountable because little project work is done, as presence of IB is assumed.

Overall, indirect effects to IB habitat in both the general forest area and the 5-mile zones from MNF activities are more positive than negative. Most MNF acreage provides potential roosting habitat and many MNF activities improve roosting

habitat. In commercial timber harvests and other activities in which trees are felled, potential roost trees are removed; however, the effects are extremely minor compared to total roost tree numbers.

A **MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT** determination is made for all activities described above but within the 5 mile zones and for prescribed fire, gypsy moth and range. A **NO EFFECT** determination is made for firewood cutting

Virginia Big-Eared Bat (Corynorhinus townsendii virginianus)

A MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for regeneration harvests, thinning and single tree selection harvests, TSI, prescribed burning, gypsy moth, road construction/reconstruction, gypsy moth, recreation, wildlife habitat improvements, range, and mineral activity on the VBEB, as the measurable impacts of these activities are more likely to be beneficial than harmful to this species. There would be **NO EFFECT** from firewood cutting, and fisheries improvement

West Virginia Northern Flying Squirrel (Glaucomys sabrinus fuscus)

WVNFS habitat on the MNF is determined before project implementation. The MNF will continue to work with WVDNR and USFWS as new information becomes available to refine the definition of WVNFS habitat to ensure the latest scientific information has been incorporated. A **MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT** determination is made for regeneration harvest, thinning and single tree selection, TSI, road construction/reconstruction, recreation, fisheries improvements, prescribed fire, firewood cutting, wildlife habitat improvements and mineral activity. A **NO EFFECT** determination is made for gypsy moth and range.

Running Buffalo Clover (Trifolium stoloniferum)

A **MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT** determination is made for regeneration harvest, thinning/single tree selection, TSI, prescribed fire, firewood cutting, gypsy moth control, road construction/reconstruction, recreation, wildlife habitat improvements, fisheries improvements, range management, and minerals activity.

Shale Barren Rock Cress (Arabis serotina)

A **NO EFFECT** determination is made for regeneration harvest operations, thinning and single tree selection, TSI, prescribed fire, firewood cutting, gypsy moth, recreation, wildlife habitat improvement, fisheries improvements, range, and minerals activities. A **MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT** determination is made for road construction/reconstruction.

Small-Whorled Pogonia (Isotria medeoloides)

A **MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT** determination is made for all forest activities.

Virginia Spirea (Spiraea virginiana)

A **NO EFFECT** determination is made for regeneration harvest, thinning and single tree selection, TSI, prescribed fire, firewood cutting, gypsy moth, road construction/reconstruction, recreation, wildlife habitat improvements, fisheries improvements, range, minerals activities, and land ownership adjustments.

REQUEST FOR FORMAL CONSULTATION – The Monongahela National Forest requests initiation of formal consultation on the **Indiana bat**. The Forest also requests concurrence from Fish and Wildlife Service on No Effect and May Affect - Not Likely to Adversely Affect findings for the Bald Eagle, Cheat Mountain Salamander, Virginia Big-Eared Bat, West Virginia Northern Flying Squirrel, Running Buffalo Clover, Shale Barren Rock Cress, Small-Whorled Pogonia and Virginia Spirea.

NEED FOR FOREST PLAN AMENDMENT - Existing standards and guidelines in the Monongahela National Forest Land and Resource Management Plan, as amended, protect special habitats and allow management of all the types of habitat needed by federally listed species Activities which protect populations and enhance habitats for these species can be carried out under general guidance provided in the current Forest Plan, as amended. However, in some cases additional, more specific guidance may be needed as identified in "Measures To Minimize Potential Adverse Effects". This is especially true in the case of the Indiana bat. It is recommended that an amendment to the Forest Plan be considered to include these concerns and any direction that may result from Consultation with USFWS and the associated Biological Opinion rendered.

REVISED PROGRAMMATIC BIOLOGICAL ASSESSMENT

MONONGAHELA NATIONAL FOREST

LAND AND RESOURCES MANAGEMENT PLAN

INTRODUCTION

PURPOSE AND NEED

In November 2000, the Monongahela National Forest (MNF) completed its initial Programmatic Biological Assessment (BA) of threatened and endangered species found on the Forest. During the course of this effort the U.S. Fish and Wildlife Service (USFWS) recommended the development of new habitat identification and management guidelines to be adopted for the West Virginia northern flying squirrel. As an outcome of this collaborative effort, USFWS amended the Appalachian Northern Flying Squirrels (*Glaucomys sabrinus fuscus) (Glaucomys sabrinus coloratus)* Recovery Plan (USFWS 1990) for WVNFS on September 6, 2001. The previous BA has been revised to ensure consistency with the updated Recovery Plan and to provide additional relevant information as required by 50 CR §402.14(c) as request by the U.S. Fish and Wildlife Service.

This Programmatic Biological Assessment documents potential effects of continued implementation of the 1986 (as amended) Monongahela National Forest Land and Resource Management Plan (hereafter called the Forest Plan) on nine federally listed threatened and endangered (T&E) species that occur on the Monongahela National Forest. Those species are: Virginia Big-Eared Bat (*Corynorhinus townsendii virginianus*), Indiana Bat (*Myotis sodalis*), West Virginia Northern Flying Squirrel (*Glaucomys sabrinus fuscus*), Bald Eagle (*Haliaeetus leucocephalus*), Cheat Mountain Salamander (*Plethodon nettingi nettingi*), Shale Barren Rock Cress (*Arabis serotina*), Virginia Spirea (*Spiraea virginiana*), Running Buffalo Clover (*Trifolium stoloniferum*), and the Small-Whorled Pogonia (*Isotria medeoloides*).

New information concerning these species has been compiled in the literature since 1986, when the current Forest Plan was approved. This BA presents state-of-the-science information regarding these species, to 1) determine if existing standards and guidelines must be adjusted or additional mitigation measures are needed to protect these species, 2) ensure that management decisions will employ state-of-the-science information regarding these species, and 3) provide a basis for a Forest Plan amendment, if one is needed.

The objectives of this Biological Assessment are to:

1. Comply with requirements of the Endangered Species Act (ESA), as amended, that actions by federal agencies (in this case the MNF) will not jeopardize the existence of these species or adversely modify their critical habitat.

2. Assess effects of current Forest Plan standards and guidelines on T&E species known to exist on or near the MNF.

3. Document current implemented standards and guidelines on the MNF that benefit these species.

4. Determine actions that should be implemented on the Monongahela National Forest to contribute toward the short- and long-term recovery of these species.

5. Provide biological input to ensure Forest Service compliance with the National Forest Management Act (NFMA), Forest Service Manual (FSM) 2670, and the ESA, as amended.

THE PROPOSED ACTION

The Proposed Action is continued implementation into the foreseeable future of the MNF Forest Plan, as amended, and projects predicated upon it. The Proposed Action includes on-going projects and future site-specific projects, until the current Forest Plan revision is complete.

BACKGROUND

AUTHORS

Six Forest Service biologists and a botanist assisted in the writing of this BA. The individual with the most expertise for a given species served as the primary author for that section which was then peer reviewed by the rest of the team and other experts.

THE ENDANGERED SPECIES ACT AND FRAMEWORK FOR THIS BA

Federal agencies must comply with the ESA of 1973, as amended. Compliance includes a requirement to consult with the US Department of Interior, Fish and Wildlife Service (USFWS) on projects that may affect federally-listed threatened, endangered, or proposed species.

The first purpose of the ESA is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved."

The Forest Service manual directs that the Forest Service will:

> Manage habitats and activities to achieve recovery objectives for T&E species.
>
> Place top priority on conservation and recovery of T&E and proposed species and their habitats.
>
> Prescribe measures to prevent adverse modification of essential habitats. Protect individuals from harm.

The MNF Forest Plan was developed to maintain or enhance species composition, structure, and function of central Appalachian ecosystems, while providing various goods and services to the American people. The Forest Plan contains several standards addressing T&E species habitat conservation.

In July 1985, consultation was completed for the Forest Plan. Six species were covered in consultation: Eastern Cougar *(Felis concolor cougar*), American Peregrine Falcon (*Falco peregrinus anatum*), Bald Eagle, West Virginia Northern Flying Squirrel, Indiana Bat, and Virginia Big-eared Bat. The USFWS opinion indicated that Forest Plan implementation likely would not jeopardize continued existence of Eastern Cougar, Virginia Big-eared Bat, and Indiana Bat. Their opinion for Peregrine Falcon and Bald Eagle was that Forest Plan implementation would promote their conservation. Similarly, for West Virginia Northern Flying Squirrel their opinion was that implementation likely would not jeopardize its continued existence, and it even may promote its conservation. Cheat Mountain Salamander, Shale Barren Rock Cress, Virginia Spirea, Running Buffalo Clover, and Small-Whorled Pogonia were not included in this consultation because they were not listed species at that time.

The Forest Plan has been amended 5 times since it was approved. For amendments that could affect T&E species, such as amendment #4 (October, 1992, revised standards and guidelines for leasing and developing federally-owned oil and natural gas), USFWS was consulted prior to amendment approval.

ESA defines "critical habitat" as specific areas within a species' occupied geographic area, at the time it is listed, which are essential to its conservation and which may require special management considerations or protection. Critical habitat also covers specific areas outside the geographic area occupied at the time of listing, which the Secretary of Interior determines essential for conservation of the species. When "critical habitat" is used in this BA, it carries the ESA definition.

Other definitions used in this BA from the Final ESA Section 7 Consultation Handbook (March, 1998), pgs xv, xvi, and xix are:

"**No effect** – the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or designated critical habitat."

"**May affect** – the appropriate conclusion when a proposed action may pose **any** effects on listed species or designated critical habitat."…

"**Is likely to adversely affect** – the appropriate finding in a biological assessment (or conclusion during informal consultation) if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial (see definition of "is not likely to adversely affect')."…

"**Is not likely to adversely affect** – the appropriate conclusion when effects on a listed species are expected to be discountable, insignificant, or completely beneficial. **Beneficial effects** are contemporaneous positive effects without any adverse effects to the species. **Insignificant effects** relate to the size of the impact and should never reach the scale where take occurs. **Discountable effects** are those extremely unlikely to occur."…

THREATENED AND ENDANGERED SPECIES NOT COVERED

In 1999, the American Peregrine Falcon was delisted as a federally protected species under ESA and, therefore, is not addressed in this BA. According to West Virginia Division of Natural Resources (WVDNR) records, the last confirmed occurrence of Eastern Cougar was 1887. WVDNR and USFWS consider this species extirpated from West Virginia, therefore, it is not covered in this BA. Although there are a few reports of cougar on the MNF, these sightings are believed to be either misidentification or captive animals that have escaped or have been released (Pers. Comm. Stihler and Tolin, 2000).

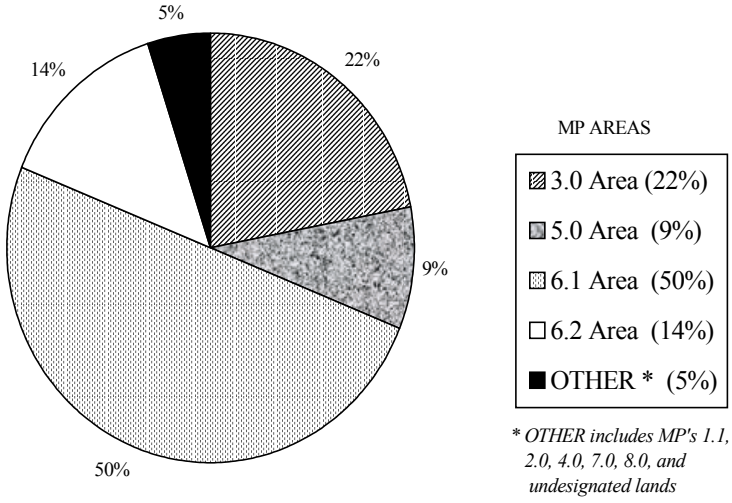
The MNF is in the historic range of the gray wolf but the last confirmed occurrence of this species was in 1900, and it is considered extirpated from the state (Stihler pers comm 1999). Therefore, the gray wolf will not be analyzed in this BA.

There is one recent record of gray bat (*Myotis grisescens*) in West Virginia. This record is of only two bats from a winter bat count in Hellhole cave in 1991. At this time, the species is considered accidental in West Virginia (Stihler pers comm 2000) therefore it will not be analyzed in this BA.

MNF LAND AND RESOURCE MANAGEMENT PLAN

The MNF's Forest Plan was approved in 1986, and was based on an extensive analysis considering long- term management opportunities, resource capabilities, and multiple public needs. The Forest Plan allocates land to specific management prescriptions (MP), each with defined long-term management objectives (a "desired future condition") and associated outputs. The Forest Plan specifies Forest-wide and area-specific standards and guidelines. The MP applied to each area is composed of the management activities allowed in that area and the associated standards and guidelines. Figure 1 summarizes Forest Plan allocation to each MP. Objectives of each MP are given in Appendix 1.

Figure 1.
Distribution of Management Prescription Areas



PROJECT PLANNING AND IMPLEMENTATION

The Forest Plan and accompanying Final Environmental Impact Statement (FEIS) describe long-range strategies for the Forest. As such, they are programmatic; that is, the Plan provides a framework for future activities and emphasizes the application of certain activities on the land, but it does not provide site-specific decisions, as to if, where, when, or how these activities will be implemented.

During implementation, when individual projects are designed, site-specific analyses are developed. These analyses usually result in environmental assessments (EA) or categorical exclusions, after appropriate public involvement and informal USFWS consultation. The MNF writes a Biological Evaluation and informally consults with USFWS on every project that has potential effects on T & E species.

AFFECTED ENVIRONMENT

GENERAL

The MNF consists of 909,409 acres of land and water in 10 eastern West Virginia counties (Barbour, Grant, Greenbrier, Nicholas, Pendleton, Pocahontas, Preston, Randolph, Tucker and Webster). The Forest is mountainous, with elevations ranging from 900 feet at Petersburg to 4,861 feet at Spruce Knob. The MNF comprises less than 6% of the state. West Virginia is 79% forested, making it the third most forested state in the continental United States.

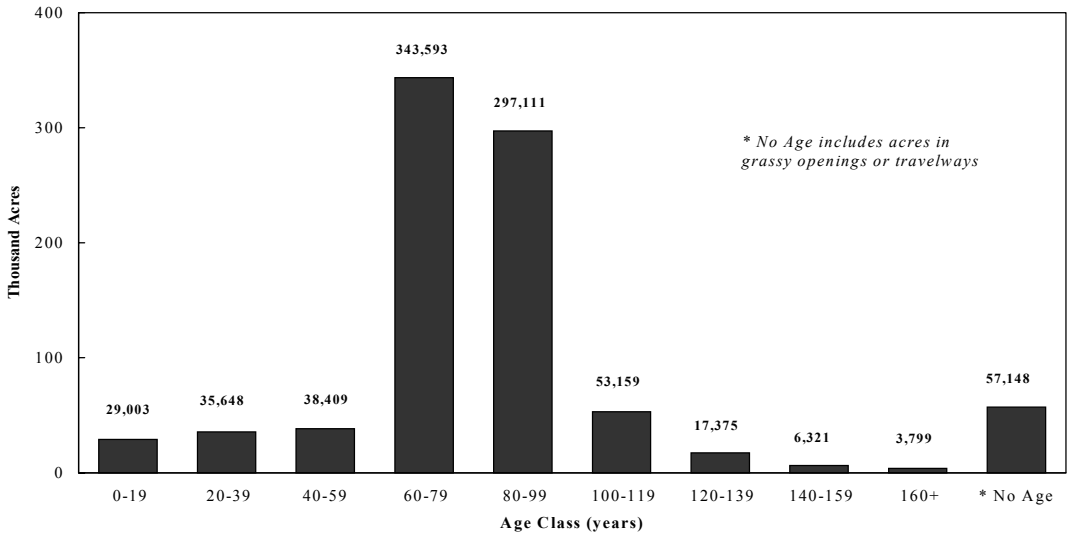
The eastern section of the Forest is in the Ridge and Valley physiographic province and has low elevation valleys interspersed with ridges running northeast-southwest. The Allegheny front separates this province from the Allegheny Plateau physiographic province in the western portion of the Forest. It has steep, rugged mountains separated by narrow valleys and numerous perennial and non-perennial streams.

Reservoirs, streams, and rivers constitute approximately 3,200 acres of the Forest. There are 600 miles of cold water and 350 miles of warm water streams, and 266 acres of man-made impoundments on the MNF, not including small waterholes/wildlife ponds developed as habitat improvements. Figures include both public and private miles of stream within the boundary of the MNF.

AGE-CLASS DISTRIBUTION

The MNF is heavily forested. About 97% of the MNF has been inventoried for age, forest type, and other vegetative conditions. The Forest Plan states “It is the ultimate objective of the Forest to balance age classes of the primary forest types on all capable, available, and suitable lands on which even aged management is applied” (Forest Plan, page 74). The following information for age-class distribution and forest types is based on those inventories. Trees of various age classes cover approximately 96% of the Forest’s land. Only 1.2% of the Forest is in the 0-9 year age class. Sixty-nine percent (610,647 acres) of the Forest is over 70 years old. In general, current age class distributions reflect turn-of-the-century activities; between 1880 and 1930 and prior to federal acquisition, most of the lands of the MNF were harvested heavily.

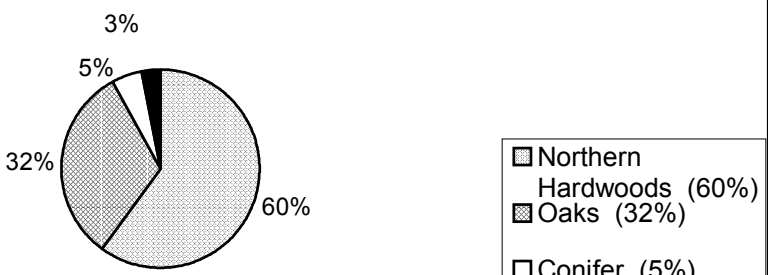
Figure 2.
Age Class Distribution



FOREST TYPES

The most common forest types on the MNF are northern hardwoods, oaks, and conifers. (See Appendix 2 for more information on forest types.)

Figure 3. Forest Types



MATURE HABITAT and OLD GROWTH

A few areas of "true" old growth, areas that appear to have been missed by logging operations at the turn of the century, exist on the MNF. These areas, due to their uniqueness and rarity, are specially protected in the Forest Plan and are designated as National Natural Landmarks, Botanical Areas or Scenic Areas. They are:

Gaudineer Scenic Area	140 ac
Shavers Mountain Spruce-Hemlock Stand	68 ac
Virgin White Pine Area	13 ac
Fanny Bennett Hemlock Grove	70 ac

The Forest Plan calls for 5% of each opportunity area (OA) in MPs where a broad range of active management can occur (such as in 3.0, 4.0, and 6.1 OAs), to be designated as old growth. Stands designated within each OA or project area are to be: selected from the oldest age classes; 10 acres or larger; dispersed throughout the area; and representative of the major local forest types. Since 1987, over 10,700 MNF acres have been designated as old growth/mature habitat during environmental analysis. On average, only 1,176 acres per year have been regenerated through even-aged management from 1987 through 1998 (or a total of 1.3 % of the Forest over 12 years), so the vast majority of the MNF will continue to age and provide mature forested habitat for the foreseeable future.

Because of this projected future abundance of mature forest, designations are not being specified as frequently as when the Forest Plan was first approved. Instead, most of the recent environmental analyses are identifying pools of areas (larger than the 5% allocation) which best meet potential mature habitat/old growth stand characteristics. Possible impacts to these areas, such as timber harvesting and road building, are discussed in the analysis. It is ensured, through the analysis, that impacts to this pool are not substantial enough to hinder the ability to designate 5% of the project area as mature habitat. Over time, the pools are monitored to determine which areas develop the strongest mature habitat characteristics, allowing for better future decisions compared to designating 5% now.

WILD and SCENIC RIVER CORRIDORS

The Forest released a draft legislative EIS which contained an analysis of various rivers or river segments for suitability as Wild and Scenic Rivers in 1995. The 14 study rivers within the MNF proclamation boundary are Shavers Fork, Dry Fork, Blackwater, Glady Fork, Laurel Fork, Otter Creek, Red Creek, South Branch Potomac, North Fork South Branch Potomac, Seneca Creek, Williams River, North Fork and South Fork of Cherry and portions of the Cheat River. Until the EIS is finalized and the resulting recommended designations are acted on, rejected, or modified by Congress, these 346.5 miles of river segments continue to be managed to not preclude their potential designation.

CURRENT AND PROJECTED MANAGEMENT ON THE MNF

TIMBER HARVESTING LEVELS

The MNF Forest Plan prescribes timber management on approximately 36% (331,160 acres) of its forest acreage. The remaining 64% of the MNF will change primarily through natural events and succession. The Forest Plan's projected annual allowable commercial timber sale quantity (ASQ) is 43 MMBF, from 6,027 acres. From 1987 to 1998, average annual timber volume sold was 27.3 MMBF from 4,055 acres. Harvest levels have been declining in recent years. From 1995 to 1998, the average annual volume sold was 15.1 MMBF, from 2,031 acres. Future annual harvest projections are estimated at 20 to 25 MMBF from 2,700 to 3,700 acres. Appendix 3 summarizes managed acres by harvesting methods and volumes sold from 1987-98.

Although Management Prescription 6.2 allows limited timber removal, including salvage of storm damage trees, no timber sales have occurred in 6.2 areas since the Forest Plan was approved and none are anticipated; therefore, potential impacts from timber harvesting in 6.2 areas will not be addressed in this BA. If timber removal is pursued in a 6.2 area, it is likely to be an isolated incident and would be handled with a site specific biological evaluation.

REGENERATION HARVEST

Even-aged regeneration harvesting is the primary silvicultural method used for Management Prescriptions 3.0, 4.0, and 6.1. Regeneration harvesting includes clearcutting with residuals, two-aged, shelterwood, and seed tree cuts. Approximately 1,176 acres have been harvested this way annually for the past 12 years. Clearcutting with residuals (i.e. culls, snags, den/cavity trees, and in some management prescriptions, additional wildlife leave tree clumps) accounted for 86% (1,007 ac/yr) of that total. However, in the early 1990s the Forest reduced its use of clearcutting as a management tool, and the acres regenerated by clearcutting on the MNF has decreased every year since 1993. Alternative harvest methods, such as two-aged, shelterwood, and seed tree harvesting are being used more frequently.

Two-aged harvesting was proposed as an alternative to clearcutting in the early 1990s to mitigate visual and wildlife concerns. Typical prescriptions under this method call for leaving 20-50 good quality 9-inch diameter or larger trees per acre, while harvesting all other commercial grade trees. Use of shelterwood and seed tree cuts has also increased, as other alternative even-aged regeneration harvesting, replacing traditional clearcuts. Culls, snags, den/cavity trees, like those left in clearcut units, also are retained in all alternative regeneration units. Alternative harvest areas also are site-prepared by cutting the smaller, noncommercial stems, down to 1-inch diameter, except for selected desirable small stems with wildlife or visual values and the leave trees. Preliminary reports suggest that desirable regeneration becomes established and can compete by these silvicultural treatments, on the areas where they have been applied.

From 1987 to 1998, the average annual combined shelterwood, seed tree, and 2-aged harvests constituted 169 acres, or about 14% of the total even-aged regeneration during those years. From 1995 to 1998, the average annual harvests by these alternative methods increased to 359 acres or about 52% of the total even-aged harvest. The percent of regeneration harvesting accomplished by alternative harvesting methods is expected to increase over time.

The average size of an individual even-aged regeneration area (includes clearcut, shelterwood, seed tree, and 2-aged harvests) on the MNF is 13 acres, with the maximum size not exceeding 25 acres.

THINNING AND SINGLE TREE SELECTION

Other timber harvest activities on the MNF include thinning and single tree selection. While the objectives of these methods differ, the resulting stands look similar. In thinning, the canopy cover is opened up moderately by removing selected overstory and suppressed trees. In single tree selection and light thins, the canopy is opened less, so canopy cover returns to nearly 100% in about 5 years. Annually, thinning and single tree selections respectively occupy an average of 2,636 acres and 243 acres on the MNF. These cutting levels are expected to remain relatively stable.

TIMBER STAND IMPROVEMENT (TSI)

Typical TSI operations include vine control, precommercial thinning, and individual tree release. With vine control, sections of individual stems of camphor (Aristolochia macrophylla) and/or grape vines (Vitis spp.) are cut off of the trees with hand tools to release the tree from the competition of the vine. During precommercial thinning or tree release, selected trees which are less than 6 to 8-inch diameter are felled and left on site or girdled and left standing as snags to reduce competition in the stand. Axes or chainsaws are normally used. On average, 941 acres per year receive TSI treatment, and this level of treatment is expected to continue.

Herbicides provide a cost-effective method of releasing seedlings by controlling competing vegetation. Treatment typically consists of direct triclopyr (Garlon 3A/4) application to individual small (<4-inch diameter) stems. Herbicide TSI has averaged 100 acres per year and this rate is not expected to increase.

PRESCRIBED FIRE

Historically, prescribed burning on the MNF has involved burning only a few grassy/herbaceous openings for wildlife habitat improvement. However, historic records suggest that oak-hickory forest types are fire dependent. Based on this assumption, approximately one-third of the Forest will have some degree of fire dependency. Therefore, it is likely that a prescribed burning program will be developed for the Forest, including burns to stimulate oak regeneration.

FIREWOOD CUTTING

Personal firewood cutting is monitored through permitting. Annually, 400-500 firewood permits authorize removal of 800-1000 cords of firewood, though actual cords cut are not monitored. Only dead and down trees (no standing dead trees) may be cut for firewood, which generally is gathered in autumn. Other than the standard "no cutting" areas, such as wilderness, botanical, recreation and active timber sale sites, the MNF is open to firewood cutting. Because vehicular access to the Forest, and firewood usually is hand-carried from cutting location to vehicle, most firewood is taken from within 150 ft of open roads or from landing sites on closed timber sales.

GYPSY MOTH

The last significant gypsy moth defoliation on the MNF lasted from 1990 through 1995. Major epizootics contributed to its widespread collapse in 1996. During the infestation period, the Forest treated an average of approximately 10,000 acres per year. In 1990 and 1991, Dimilin, a synthetic pesticide that kills moths and butterflies in the order

Lepidoptera was used. Since then, only biological insecticides have been sprayed on MNF lands. From 1992 to 1995, 32,596 total acres were treated aerially. *B.t.,* a biological pesticide that also kills moth and butterfly caterpillars in the order Lepidoptera, was sprayed on 17,425 acres (53% of treated lands); Gypchek, a biological pesticide specific to gypsy moths, was used on 15,171 acres (47% of treated lands). Scattered pockets of gypsy moths have been recorded on the MNF in 2000.

In 1994 a 10-year non-target study was initiated to:

- Collect baseline data on Lepidoptera, other herbivorous, predacious and parasitic arthropods, songbirds, and salamanders in plots that represent forest types vulnerable to gypsy moth.
- Evaluate the effects of multiple, but not more than three, applications of *B.t.* and Gypchek, from 1997-2001.
- Identify the best indicator communities or species among arthropods for evaluation of *B.t.*

Nine 500-acre plots on the Greenbrier and Marlinton Ranger Districts have been established for this study. Three plots were treated with *B.t.* and 3 with Gypchek in 1997 and 1998. The remaining 3 plots are controls, which are not treated. The study is still ongoing.

Forest philosophy concerning gypsy moth defoliation is to treat only those areas where defoliation effects would make achieving management objectives difficult. For example, where the management objective is to provide developed recreation opportunities, much lower populations may be treated than in the general forest. Blanket treatment of all areas is not done. Recently, the fungus *Entomophaga maimaiga* has been maintaining low gypsy moth populations; consequently only the study sites have been treated since 1995. Future treatment would be proposed only if gypsy moth populations dramatically increased.

ROAD CONSTRUCTION/RECONSTRUCTION

The 3 major road types on the MNF are system, temporary, and woods roads. System roads are designed for decades of use. Temporary roads are designed for use during specific projects, and are "put to bed" by installing water bars and seeding the surface after project completion. Woods roads are neither system nor temporary roads; they simply are travel ways in the woods created by past activities. Examples are old logging or mining roads or railroad grades. As areas of the Forest are reviewed for potential projects, woods roads are abandoned, or converted to trails, wildlife openings, or system roads. From 1987 to 1996, the MNF abandoned 288 miles of woods roads (i.e. let them grow up with vegetation or obliterated them) and converted 281 miles to system roads. The canopies over almost all woods roads are closed or nearly closed. Appendix 4 supplies road mileage changes, road densities by management areas, and status of system road closures.

The MNF manages approximately 1,786 miles of system roads. Of these system roads, 538 miles are open to vehicle traffic year round, and an additional 152 miles are open seasonally. Current and future road management emphasizes use and reconstruction of acceptably located existing corridors, rather than new road construction. During the past 5 years, an average of 15 miles of roads per year have been constructed and 15 miles reconstructed. Future construction is projected not to exceed 15 miles per year, which results in 47 acres each year are converted to road corridors.

The Forest Service recently implemented an interim rule temporarily suspending road construction and reconstruction in most National Forest roadless areas. This interim rule expired in August of 2000 but a revised National Forest Road System management plan is forthcoming. The intent of the interim rule was to safeguard significant ecological values of roadless areas from potentially adverse changes associated with road construction, while improved analytical tools are developed to evaluate the impact of locating and constructing roads.

The final road management policy will have 3 expected outcomes. Fewer forest roads will be built and those that are built will be designed to minimize environmental impacts. Unneeded or environmentally damaging roads will be obliterated. Heavily used roads will be made safer. As part of this effort the Forest Service is preparing a national EIS to examine effects of building and not building roads into "unroaded" areas. The draft EIS was released for public comment in May of 2000. The EIS is looking at the effects of building/not building roads in unroaded portions of inventoried roadless areas and adjacent areas 1000 acres and larger. The EIS also evaluates the need for additional analysis of road building in other areas 1,000 acres or larger. This may result in the prohibition of road building in some parts of the MNF, where it is currently allowed.

RECREATION

Since the construction of Seneca Shadows Campground in the mid-1980s, no large recreation construction projects requiring forest habitat clearing have occurred. Annually, only a few hazard trees are removed from campgrounds and picnic areas. In 1998, the construction of the Seneca Rocks Discovery Center and associated parking lots required clearing of some trees, but nearly all of the construction occurred within an existing opening.

Most trailhead parking areas are built to accommodate about 5 to 10 vehicles and require few, if any, trees to be removed. The few larger trailheads that have been developed since the Forest Plan was approved were in fields, requiring no tree clearing.

Recent trail construction projects primarily have involved bridge installation and trail relocation. The MNF builds or relocates 6-10 miles of trails each year. The canopy is closed or nearly closed on most forest trails. Future construction of large-scale developed-recreation sites is unlikely due to funding constraints and the Forest Plan emphasis on dispersed recreation. New trail and parking area construction projects will focus in areas where projects are accomplished with partners or special funding. Currently, the MNF has grants to build a parking lot in a grassy, roadside area at the intersection of the Highland Scenic Highway and U.S. Route 219, an interpretive/wildlife

viewing trail in the Tea Creek Meadow area, and an interpretive trail in the "honeycomb rocks" formation along the Scenic Highway. A few trees will be removed for this trail construction. Multi-agency rail-to-trail conversion also may be implemented.

Forest disturbance from trail maintenance is minimal because it generally involves only blowdown and hazard-tree removal but no overstory-tree clearing.

Recreational caving (spelunking) on the MNF varies from little to no use on remote, inaccessible caves located on the Forest to very heavily used, easily assessed caves. Of the 257 inventoried caves on the MNF, fourteen (14) are characterized as experiencing "high use". Eleven caves contain sensitive animal species and some form of management has been initiated on each. Five caves within the Forest are gated or closed to sport caving for at least part of the year to protect threatened or endangered species and sensitive habitats (EEI GEO 1992).

WILDLIFE HABITAT IMPROVEMENTS

While several hundred acres of wildlife habitat restorations and enhancements are completed annually, only about 30 of these acres are new wildlife openings. Nearly all of these new openings are created from log landing sites in timber sales. Most work on the remaining acres involves maintaining previously-created habitat improvements (e.g., mowing wildlife openings), and to a lesser extent placing nestboxes (bluebird, squirrel, wood duck, etc.) and nesting platforms, planting mast trees/shrubs, pruning and grafting fruit trees, and releasing soft and hard mast trees/shrubs. A major emphasis in the early 1990s was the creation of dozens of wildlife waterholes annually, in areas that lack permanent water sources. That rate has slowed down more recently, with approximately ten waterholes constructed annually for the past 3 years.

Threatened, endangered, and sensitive species management predominantly involves surveys for these species and then avoidance of occupied/potential habitat or other mitigation during project activities. Very little ground-disturbance has occurred from habitat improvement projects for these species, although some thinning in conifer areas has been done to improve habitat for the West Virginia northern flying squirrels. Cave gates have been constructed to protect rare bat habitat. Nestboxes placed for population monitoring (i.e., for West Virginia northern flying squirrel) are left in place following monitoring to provide additional nesting cavities.

FISHERIES IMPROVEMENTS

The fisheries program currently is focusing on stream inventories and monitoring, and aquatic habitat classification, and includes limited habitat improvements. Current and projected water quality improvements primarily are limited to WVDNR's efforts to lime acidic streams. Approximately 125 stream miles are treated annually via direct limestone-fine additions or with limestone drums. Drums are operated on the North Fork Cranberry River, Dogway Fork of Cranberry River, and Otter Creek. This level of treatment is expected to continue.

The MNF focused its fisheries management program on habitat enhancement projects in the past. On-site materials were used; activities included felling selected trees into the channel or utilizing downed logs or boulders to increase habitat complexity, and spawning and rearing potential. In recent years and in the foreseeable future, fish habitat improvement structure installation is limited primarily to areas where such work will be funded through partnerships funds or KV dollars, which are generated by timber sales. Riparian protection, natural large wood recruitment for habitat restoration and maintenance, and watershed health are emphasized. Toward that end, the MNF has increased emphasis on riparian area protection. Most timber harvesting projects now employ these guidelines as mitigation measures:

- Maintain at least a 75% canopy closure for 100 ft on each side of perennial streams
- Maintain at least 50% canopy closure for 50-100 ft on each side of intermittent streams, width depends on watershed size
- Maintain 6 trees per 100 linear feet on ephemeral streams

Road standards and timber harvesting methods are also more sensitive to watershed conditions, and watershed restoration projects are increasing.

RANGE

The MNF administers 52 total grazing allotments on the Cheat, Potomac, Greenbrier, and Marlinton Ranger Districts, comprising approximately 7,000 acres. Each year some (usually less than 5) allotments are not grazed during the normal May 15 through October 15 grazing season, to rest them or for administrative reasons. This program is expected to remain stable into the future.

MINERAL ACTIVITY

Mineral exploration and development has occurred on the MNF for decades. Coal mining and natural gas development and storage are the primary mineral activities that require land clearing and alter habitats.

Coal Mining History and General Effects

Underground coal mining occurred within the boundaries of what is now National Forest before these lands were designated as the MNF. Mining for privately owned coal under MNF land continued into the early 1990s. Surface coal mining occurred from late 1940s through the 1950's. The MNF has acquired some lands that were surface-mined prior to becoming National Forest land.

Coal mining requires land clearing and earth disturbance to construct haul roads, to develop openings for underground mines, to remove soil and rock to surface mine, and often to develop coal processing or loading facilities. Clearings that exist from past coal mine development are shown on Forest vegetation cover type maps.

Future Coal Mining and Reclamation

Active coal mining on the MNF ceased in the early 1990s, and no coal mine permit applications are pending or known. Coal reserves are scattered and would be costly to develop due to the geologies involved; therefore, the MNF does not foresee near-term significant coal mine development. However, should private coal owners develop their coal, 2-12 acres of MNF lands would be cleared or disturbed for an underground mine site and several additional acres for a haul road, depending on road length.

The MNF plans to restore certain lands impacted by past coal mining. This could involve clearing trees that have regrown or been replanted to restore natural drainage or install acid mine drainage treatments. Clearing and earth disturbance for these restoration activities could affect scattered abandoned mine areas around the MNF. Generally 1-2 acres of existing abandoned underground mines and adjacent areas would be cleared. For surface mines, area of disturbance would depend on the overall size of the surface mine and amount of perimeter normally ranging from 2 – 15 acres.

Natural Gas Storage

A 50,000-acre natural gas storage field was developed in the 1960s beneath the MNF in the Middle Mountain-Glady area. Land clearing for gas well sites (1-2 acres each), gas pipelines and access roads required for this field development is reflected in Forest vegetation cover type maps. Recent gas field storage capacity expansion has cleared approximately 1 additional acre at each of 3 well sites. Future expansion and clearing the Glady gas storage field is not anticipated.

Natural Gas Development Activity

Past natural gas activity

Natural gas exploration and development in the MNF began in the 1950s. Within the Forest Proclamation Boundary, 41 producing or capable-of-producing gas well sites exist. For each, 1-4 acres has been cleared. Additionally, approximately 108 miles of natural gas pipeline and 12 miles of access road exist. Total clearing for these facilities, including gas well sites, is about 620 acres (Environmental Assessment, Oil and Gas Leasing and Development, MNF, August 15, 1991, Appendix C; Cabot Oil and Gas Corporation Gas Wells Proposal Environmental Assessment, 1997; Thornwood Gas Pipeline Environmental Assessment, September 1995). Twenty-three of these wells and their associated facilities, including the 34-mile long Thornwood Gas Pipeline constructed in 1996 and the first 2 Horton Gas Field wells drilled by Cabot Oil and Gas Company in 1998, are on MNF land.

Future natural gas activity

Reasonably foreseeable gas development was projected and described in general terms in May 1990 (Environmental Assessment, Oil and Gas Leasing and Development, MNF, August 15, 1991, Appendix C, and Bureau of Land Management report "Reasonable Foreseeable Development Scenario for Natural Gas within the MNF, WV, 1990-2000", May 1990). This general projection still reflects expected gas development over the next 10 years, even with recent increased interests in MNF natural gas deposits as drilling for small gas pockets has become more economical. These disturbed-acreage estimates for the MNF are reasonable because 1/4 to 1/2 of all projected gas development could occur on private land within the proclamation boundary, as is the current situation. Additionally, recent advances in directional drilling technology, described above, allow less land clearing and road and pipeline construction than older methods, which would further reduce the projected clearing amounts.

The MNF is reviewing a proposal to fully develop the Horton Gas Field. Directional drilling is proposed so 2-3 wells can be located on a single pad to reduce forest and soil disturbance. The proposal includes 22 new wells on 11 pads (8 new pads and 3 existing pads) to be drilled over 5 years with approximately 33 acres of disturbance. Several other lessees are considering additional well development within existing gas fields, and some exploratory gas drilling also may occur. Planned and potential gas developments over the next 10 years are expected to involve:

- Clearing about 140 acres for 68 gas well sites; each site approximately 2 acres.
- Clearing about 138 acres for approximately 19 miles of new road to access projected well drilling.
- Clearing about 497 acres for 82 miles of gas pipeline from an estimated 43 producing wells (out of the 68 drilled wells); Rights-of-way may be up to 50-ft wide.

It is likely that some of the 68 wells will not yield gas. Consequently, an estimated 50 acres may begin reverting back to forestland shortly after drilling. Cleared areas from producing wells will remain open, supporting herbaceous vegetation, throughout gas production of probably up to 30 years.

Using standards and guidelines for gas development (reference: MNF Forest Plan, pages 52, and 230-234; various Oil and Gas Leasing and Development decision documents and analysis records, including Decision Notice and Finding of No Significant Impact, Oil and Gas Leasing and Development, 9/30/91, pages 15, 17, and 18, and "Issues, Concerns, and Opportunities Not Addressed in the Analysis, July 1991, pages 8-11.) reduces chemical and physical disturbances in caves to acceptable levels. Therefore, this BA focuses on habitat changes created by forest clearing for well, access road, and pipeline development.

LANDOWNERSHIP ADJUSTMENTS

Types of land adjustment transactions include purchases, exchanges, donations, Small Tracts Act sales/interchanges, transfers, condemnations, Town site Sales, and others. Acreages acquired or exchanged vary substantially year to year. For example, no land is acquired some years, while 41,000 acres were acquired in 1987-88. From 1986-1997, 50,179 acres were purchased by the MNF -- an average of 4,182 acres per year. Historically, exchanges have been a very minor component of landownership adjustments; with about 1,000 acres involved over the same 12 years.

Future adjustments are difficult to project. Typical average ranges of acquired land are 20-200 acres per year with infrequent larger acquisitions. Exchanges usually result in little net change to MNF acreage. The primary reason for exchanges is to obtain privately owned land located within otherwise-large blocks of MNF land. Typically, the private land is surrounded by MNF lands on 2-4 sides. Similarly, acreages of MNF surrounded by private lands are traded away during exchanges. For both acquisitions and exchanges other considerations include protection of: rare species and their habitats, heritage resources, riparian areas, and/or other unique resources.

SUMMARY

See Appendix 5 for some summaries of Forest Plan activities.

THE FOLLOWING STANDARDS AND GUIDELINES FROM THE FOREST PLAN APPLY TO ALL T&E SPECIES:

General Forest-wide **Page**

Management and implementation of recovery plans will be coordinated with WVDNR Universities, Forest Service research, USFWS, Heritage Foundation, as stated in current agreements, memo of understanding or law 52

Review all permittee, licensee, and grantee pesticide-use proposals and plans to insure that all uses of pesticides on NFS lands conform to Forest Service Policy. Approve only those proposals that comply with FS requirements 58

Coordinate with Federal and State wildlife management agencies (FSM 1950) in order to determine that proposed pesticide use will not adversely affect endangered or threatened animal or plant species, or their critical habitats.....58

Use only pesticides registered by the Environmental Protection Agency (EPA) in full accordance with the Federal Insecticide, Fungicide, Rodenticide Act as amended, except as otherwise provided in regulations, orders, or permits issued by the EPA.....58

The aerial application of pesticides is prohibited when wind velocity exceeds 6 mph, temperature exceeds 85°F, relative humidity is less than 50%, rain or foggy weather is present or the air becomes turbulent 59

Shade strips will be required on perennial streams within forested areas (shade strips defined as normally 100 feet on either side of stream) 79

Fish and wildlife habitats will be managed to maintain viable populations of all existing native vertebrate species and to maintain or improve habitat of management indicator species 83

Exotic fish or wildlife species will not be transplanted to or within National Forest lands unless the transplanting is part of an endangered species program 84

Management of habitat critical to T&E wildlife and fish species is considered the first priority management activity. Forest personnel will work with State agencies and the USFWS, in identifying T&E species and critical habitat areas. The requirements of Endangered Species Recovery Plans will be fully coordinated with the Forest Plan. The Forest Service, USDA, will participate in the development of recovery plans for all T&E species 84

Federal Oil and gas may be leased subject to the standards and guidelines identified in the Forest Plan (including Plan Appendices - primarily Appendix K).....90

T&E, and sensitive flora and fauna and their habitat will be protected. See Plan forest-wide standards and guidelines 2670, special area zoological area standards and guidelines, namely Essential Habitat for T&E bats and Occupied Habitat for Virginia Northern Flying Squirrel (VNFS), Plan Appendices X (VNFS) and U (Sensitive Plant and Animal Species), and any recovery plans for T&E species K-15

The following priorities will exist for lands acquisition.

Priority	Description
2	Lands or rights needed to protect or reestablish T&E species of plants and animals 94

National Forest land can be exchanged provided the exchange will accomplish management objectives and be to the advantage of the United States. Exchange proposals will be evaluated with NEPA process and must consider impacts on wetlands, floodplains, and T&E species 96

MP 6.1
T&E and sensitive species will be managed to ensure their protection.....179

MP 6.2
Only those new wildlife habitat improvements that (1) are compatible with the recreation objectives, (2) can be built and maintained without additional roads or extensive tree cutting, and (3) are needed for T&E, or sensitive wildlife species habitat needs will be permitted 188

MP 9
No National Forest management practices to provide wildlife habitat will occur, except activities specified in Recovery Plans for T&E species, and management of road and trails……..208

ACTIONS THAT HAVE COMMON EFFECTS TO ALL THREATENED OR ENDANGERED SPECIES CONSIDERED IN THIS BA

LANDOWNERSHIP ADJUSTMENTS

Landownership changes would not directly affect T&E species.

Indirect effects of changing ownership are difficult to generalize. Effects depend on the specific exchange proposal. If the MNF acquires land with high quality habitat, the effects would be beneficial, as additional protective measures inherent to public lands would be applied. If the MNF loses high quality habitat, although this would likely occur very rarely, the effects to T&E species could be negative. Therefore, each adjustment is analyzed carefully and individually. In most cases, surveys are conducted in proposed exchange areas to evaluate the potential effects to listed species. It is extremely unlikely that the MNF would exchange away any tract containing quality habitat for a threatened or endangered species. Therefore, landowner adjustments are not likely to have an adverse affect, either singularly or cumulatively, on any species considered in this BA.

DETERMINATIONS

All determinations are based on the assumption that the "Measures to minimize potential adverse effects" will be implemented.

SPECIES NARRATIVES

BALD EAGLE

On July 12, 1995, the USFWS reclassified the bald eagle, Haliaeetus leucocephalus, from endangered to threatened throughout the lower 48 states (Federal Register, July 1995). Previously, it had been listed as endangered in all states except Washington, Oregon, Minnesota, Wisconsin, and Michigan. In the latter states, it was and continues to be listed as threatened. On July 6, 1999, the bald eagle was proposed to be delisted, based on recovery data. Public comment for this proposal ended October 1999, and USFWS is currently reviewing comments.

USFWS divided the 48 states into 5 recovery regions, for which plans were written. The MNF falls into 2 of these regions; the Chesapeake Bay region includes the eastern panhandle of WV, and the Northern States region includes the rest of the MNF.

DISTRIBUTION

Bald eagles breed from southern Alaska, throughout much of Canada, into the Great Lakes region and south along the Atlantic coast (WVDNR, 1987). Ten active eagle nests exist in WV as of 1999. One nest, discovered in 1987, is in the Smoke Hole area of the MNF, along the South Branch of the Potomac River, in a 6.2 management area. This nest site, which is in the Chesapeake Bay recovery region, has steep slopes and a closed canopy forest predominated by deciduous trees and some white pines. The nest is well buffered from the river by mature forest and can only be seen from a 0.25 mile stretch of the river. No roads or homes exist near the nest, and it is surrounded by MNF land. All other WV nests are east or northeast of the MNF, (except one along the Ohio River). The closest nest in Virginia is a nest at Lake Moomaw that is 5 miles east of the MNF.

REPRODUCTION

Bald eagles nest in pine and hardwood trees near water, and nest building occurs between November and January. Egg laying follows in February or March (Cline, 1985). Reproduction at the MNF nest site has consistently produced young in the last several years as shown in Table 1.

Table 1. Numbers of eaglets produced at the Smoke Hole bald eagle nest site.

Year	# Eaglets Fledged
1990	3
1991	2
1992	2
1993	1, maybe 2
1994	1
1995	Unknown
1996	3
1997	1
1998	1
1999	2
2000	2

FOOD HABITS

Eagles nest, roost, and forage near lakes, rivers, and large streams where fish and occasionally waterfowl are taken. Eagles are opportunistic, feeding on deer carcasses and other carrion when available.

GENERAL HABITAT CHARACTERISTICS

Breeding most often occurs within 1 mile of the water bodies that provide the primary food sources (USFWS 1990). Nests are built in super-canopy trees, approximately 100 yards from the nearest forest edge (Cline 1985). Overall, bald eagles prefer areas with limited human activities (Buehler et al. 1991).

HABITAT ON THE MONONGAHELA NATIONAL FOREST

The MNF Smoke Hole area provides good forage and nest habitat. Although the MNF has no large lakes or impoundments, smaller lakes, such as Buffalo Lake, Summit Lake, Spruce Knob Lake, and Lake Sherwood, provide potential habitat. These lakes may be used primarily by non-breeding eagles traveling south from northeastern breeding areas, or north from southern breeding areas (USFWS 1990). Larger river corridors, such as the South Branch of the Potomac, also provide potential nesting and feeding areas. People have observed eagles near rivers and lakes, usually during migration.

CAUSES OF PAST/CURRENT DECLINE

Pesticide (DDT and DDE) and heavy metal accumulations reduced bald eagle reproduction and caused most of its decline (Cline 1985); however, shoreline and wetland destruction also have eliminated eagle habitat. Suspension of DDT use in 1972 has resulted in substantial population increases, and bald eagle numbers are no longer declining (hence the proposed delisting).

Direct human disturbance has also caused eagle numbers to decline. Eagle shootings also have decreased eagle numbers. Several eagles have been shot in WV in the past decade. Shootings and disturbance at nest sites are the biggest factors affecting eagles in this state (Stihler pers. Comm. 2000).

Habitat destruction and degradation via shoreline development, recreational waterway and shoreline use, and nonpoint and pointsource water pollution still threaten bald eagles in some areas (Federal Register 1995).

FOREST PLAN STANDARDS AND GUIDELINES PERTINENT TO THE BALD EAGLE

Forest-wide Standards and Guidelines specify:

The search for eagle and osprey nests on the Forest will continue. Any nesting sites found will be protected 86

Because eagles use riparian areas to forage, the following standards and guidelines apply for riparian land and vegetation approximately 100 feet wide along both sides of streams, which are at least 30 feet wide as of June 15:

> Protect all standing dead trees, except for public safety in trailside areas.....87
>
> Major occupancy developments in riparian areas will not be encouraged but considered on a case-by-case basis through the Environmental Analysis process...88

The known bald eagle nest on the MNF is in a 6.2 MP. That MP has the following general directions that are pertinent to this species:

> Trees may be cut only to aid in development of dispersed recreation, to enhance public safety, for insect and disease control, or to salvage timber and restore areas severely damaged by hurricanes or ice storms, or other natural phenomena beyond human control.
>
> Also, recreation management will strive to maximize the area's potential to provide semi-primitive non-motorized recreation opportunities 185

EFFECTS OF CONTINUED IMPLEMENTATION OF THE FOREST PLAN

Eaglets have been produced and reared in the Smoke Hole nest since its discovery in 1987. Eagle populations throughout West Virginia have increased simultaneously with national numbers.

Regeneration Harvest

The direct effects of harvesting are that nest trees could be felled, thereby destroying eggs, killing chicks, or disrupting a mating pair causing nest abandonment.

Indirect effects occur as trees are cut near or along shorelines reducing known or potential roosting or foraging perches. New nests must be built if nest trees are cut. However, since nest trees fall naturally, eagles are adapted to locating new nest trees. Noises and disturbances during harvesting could reduce habitat suitability. Elevated sediment deposition in streams from harvesting operations could cause fish declines, thereby reducing the eagle's primary food source. On the positive side, edges created by harvesting increase sunlight to edge trees, enhancing growth of super canopy, potential nesting trees.

The Smoke Hole nest site is in a 6.2 area, where timber harvesting is extremely unlikely. Additionally, this nest and any new nest sites would be avoided in timber harvest proposals. Therefore, there will be no direct or indirect regeneration harvest effects to nest sites. More generally, due to the visual and environmental sensitivity of river corridors and lakeshores, little if any regeneration harvesting in any potential eagle habitat in the MNF will occur. Thus, habitat suitability will remain stable or increase.

Thinning and Single Tree Selection

Thinning and single tree selection have the same direct effects as a regeneration harvest. Again, nest sites will be avoided, so no effects are predicted.

The indirect effects of thinning would be producing gaps, thereby promoting super-canopy growth. Some thinning may occur near shoreline areas with potential eagle habitat. However, no thinning will occur near the active nest site, as thinning is not permissible in a 6.2 area.

Timber Stand Improvement (TSI)

TSI work principally involves girdling or killing small understory trees. Tree removal, itself, would not affect eagles, but direct negative effects from TSI could result from chainsaw noise, fumes, and general human disturbance in the area, particularly during mating and nesting. No TSI will occur in the active nest area because it is a 6.2 area and any future nest sites would be avoided.

TSI has no indirect effects because overstory habitat structure is not changed. Also, herbicides used in TSI are applied to individual stems to eliminate nontarget effects and they do not contain heavy metals.

Prescribed Fire

To date, most acres burned with prescribed fires on the MNF have been in grazing allotments and openings. Eagles would be directly affected by smoke and disturbance from such fires only if the burn is adjacent to a nest site. Understory burning has been done for site preparation of some regeneration harvests, and future sites are proposed. Direct effects would occur only if the fire occurred in the area around a nest tree. Prescribed burning would not affect habitat since mature trees are not killed. Also, the known MNF eagle nest is in a 6.2 area and prescribed burning in not permissible in 6.2 areas. If prescribed fire were ever proposed near a nest site, appropriate restrictions would be implemented to ensure the nest was not impacted (e.g. buffer areas, seasonal burning restrictions).

There are no indirect effects of prescribed fires on bald eagles, as the prescribed fires that occur or may be proposed on the MNF are not designed to substantially alter habitat.

Firewood Cutting

No direct, indirect, or cumulative effects from firewood cutting exist for bald eagles. Only dead and down trees may be cut for firewood on the MNF; most of this is wood is cut along open roads, which is not preferred bald eagle habitat.

Gypsy Moth

No gypsy moth spraying has occurred since 1995, but it may occur, depending upon future gypsy moth populations. Because the chemical and biological sprays used to control gypsy moth do not contain heavy metals or chemicals that affect eagles, no direct, indirect, or cumulative effects would occur from gypsy moth control.

Road Construction/Reconstruction

Road building would have the same effects as a regeneration harvest as it includes tree cutting, noise, and human disturbance.

If a constructed or reconstructed road is open to public access, the area may become less suitable for bald eagles due to increased disturbance. Given the limited amount of annual MNF road construction and reconstruction, and the unlikelihood that shoreline road construction will occur, the potential for indirect effects is small.

The active eagle nest will not be affected directly or indirectly by road building because of the area's 6.2 status.

Recreation

Recreation, particularly water or shoreline recreation near a nest, perch, roost, or forage site, can disturb bald eagles. However, all MNF impoundments are small and not likely to support resident eagles, so lake-based recreational facilities on the MNF will have no effects.

The South Branch of the Potomac is used heavily for boating and fishing. The Smoke Hole area is popular for canoeing and fishing from late March through mid June. One outfitter/guide permittee leads approximately 100-120 trips through the area during this period each year, but most use is by the general public. Because eagles are most active in morning and evening, people traveling through the area during the day may disturb the eagles less than those who camp overnight or who travel near the nest during morning or evening. People have been observed camping close enough to the eagle nest to agitate the eagles (Stihler pers. Comm. 2000).

Recreational use has existed in the Smoke Hole area for years, and the eagles have survived and reproduced successfully. Thus, current disturbance levels are not problematic. However, MNF outfitter guide permits, in general, indicate overall increasing recreation-use trends. Therefore, recreation in the Smoke Hole area eventually may increase to levels that would inhibit eagle use of the area.

Wildlife Habitat Improvements
The only direct effects from creating openings involve cutting potential bald eagle nest trees.

Small openings and savannas can promote dominant tree growth along edges, which may be used for nesting, perching, roosting, or foraging, depending on their location relative to substantial water bodies. Waterhole construction and other minor activities, such as planting shrubs, would not affect eagles. No openings or other improvements are planned near the existing Smoke Hole nest.

Fisheries Improvements
Fisheries habitat improvements involve cutting a few trees, but this work occurs along small streams that do not provide habitat for nesting eagles. Therefore, MNF fisheries habitat improvements do not directly affect eagles. Indirectly, habitat improvements may increase fish populations downstream, thereby increasing eagle food sources.

Range
Range allotments constitute a very small percentage of the MNF. Livestock grazing keeps range allotments open. No range allotments exist near the eagle nest site, but two occur along river corridors. Continued grazing of existing allotments would not directly or indirectly affect bald eagles. Terminating the grazing of these riverside areas, however, and allowing them to return to a forested condition, would slightly increase the available eagle habitat. Due to the extremely small percentage of available habitat on the MNF that is in these allotments, the beneficial effect of allowing reforestation of these areas would be considered discountable.

Mineral Activity
Mineral activities near nest or perch areas could directly affect eagles. Timber felling and other related disturbances are required for most mineral development. However, no mineral activities are planned near the current nest site. Future nest sites would also be avoided. Clearings developed during mineral activities would have the same indirect effects on potential habitat as wildlife clearings.

SUMMARY OF CUMULATIVE EFFECTS

Proposed delisting indicates region-wide eagle populations are stabilizing. Current Forest activities do not appear to be negatively affecting the bald eagle nest on the MNF, as young are being fledged annually. Past and present management has been conducive enough to the bald eagle to have led to the increase and stabilization of the eagle population on the MNF. The nest area is in a 6.2 area, which will have limited future management. In addition, the Forest Plan directs that eagle nests will be protected.

Although a substantial recreation-use increase in the Smoke Hole area could detrimentally affect bald eagles, an increase of this magnitude is not expected in the foreseeable future of the next 5 to 10 years. To-date, recreational use on the South Branch of the Potomac has not negatively affected the known nest. Elsewhere on the MNF, cumulative effects to bald eagle habitat will be minimal since little management or disturbance would occur along shorelines. The large, easily visible nests minimize the potential that nests would be accidentally disturbed by management activities

SUMMARY OF POTENTIAL EFFECTS ON THE BALD EAGLE

Potential Beneficial Effects:

1. Tree cutting for any activity could increase super-canopy tree availability along shorelines.

Potential Adverse Effects:

1. Substantially increased recreational use of the Smoke Hole area could inhibit eagle reproduction or their use of the area.

DETERMINATION

Forest Plan-directed actions are not affecting the Smoke Hole eagle nest adversely. Further, effects to potential eagle habitat are minimal, because tree felling along shorelines is extremely limited. Super-canopy trees along edges also may result from shoreline management, thereby creating additional potential habitat. Recreation use in the Smoke Hole area is not expected to increase substantially enough in the foreseeable future to affect nesting eagles.

Therefore, a MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for regeneration harvesting, thinning and single tree selection, prescribed fire, road construction/reconstruction, recreation, wildlife and fisheries habitat improvement, and mineral activity. A NO EFFECT determination is made for TSI, firewood cutting, gypsy moth, and range.

Measures To Minimize Potential Effects to the Bald Eagle

1. Continue WVDNR partnership to monitor the Smoke Hole nest and look for new bald eagle nests

CHEAT MOUNTAIN SALAMANDER

On September 28, 1989, the U.S. Fish and Wildlife Service (USFWS) determined that the Cheat Mountain salamander (CMS), *Plethodon nettingi* Green, 1938 was in threatened status (Federal Register, Vol. 53, No. 188:37814-37818). A Cheat Mountain Salamander Recovery Plan was released on July 25, 1991 by the USFWS.

DISTRIBUTION

CMS is a relict species of 59 disjunct (Pauley and Pauley 1997) and genetically isolated populations (Kramer et al. 1993). It is geographically restricted to high elevation forests containing a red spruce component (Highton 1971, Pauley and Pauley 1997) and mixed deciduous forests with a *Bizzania*-dominated forest floor (Pauley and Pauley 1997). The highest elevation at which CMS has been recorded is 1482 m (4860 ft), on top of Spruce Knob (Tom Pauley pers. comm). Their range is a 700 square mile area exclusively within West Virginia (Pauley 1991), with 88.2 percent of the known populations located within the MNF. Seventy-five percent of the known populations have less than 10 individuals (Pauley 1991). Distributions of CMS includes Tucker, Randolph, Pocahontas, Grant, and Pendleton Counties (Pauley and Pauley 1997) extending from Backbone Mountain in the north to Back Allegheny Mountain in the south, see Figure 6. Historically, the range of CMS was likely more extensive than it is today. Natural events and extensive logging eliminated over 93 percent of the original spruce acreage by 1920 (Clarkson 1964).

REPRODUCTION

While the age of sexual maturity for CMS has not been determined, once females become sexually mature, they deposit egg clusters containing 4 to 17 eggs (Green and Pauley 1987) every other year (Pauley 1991) between late spring and mid summer (Green and Pauley 1987) under refugia, such as rocks or rotten logs (Green and Pauley 1987). The eggs are usually guarded by the female (Pauley pers. comm.).

FOOD HABITS

The CMS diet includes mites (42.1%), springtails (17.8%), beetles (16.4%), flies (9.3%), ants (4.3%), and various other insects (10.0%) (Green and Pauley 1987, Pauley 1980). Foraging on the forest floor and occasionally on tree trunks is done at dusk (Green and Pauley 1987) when relative humidity is high (Spotila 1972). On dry nights they do not leave their moist retreats to forage (Spotila 1972).

GENERAL HABITAT CHARACTERISTICS

The plethodontid salamanders, of which CMS is a member, are characterized by the absence of lungs. As such, respiration through the skin, or cutaneous respiration (Feder, 1983) occurs, for which the skin must remain moist to permit oxygen permeation. Moist skin also is needed for cutaneous absorption of water (one mechanism amphibians use to maintain their internal water balance) because they do not drink water (Heatwole and Lim 1961). Salamanders have preferred temperature ranges that minimize dehydration (Spotila 1972). Because of these physiological requirements, CMS survival requires microhabitats with high relative humidities or moisture (Feder 1983, Feder and Pough 1975) and acceptable temperatures. Foraging and mating, thus, are inhibited or enhanced by these external conditions (Keen 1984).

Vegetative structure also affects salamander populations. Moist old growth stands have greater abundance and species richness than dry old growth or younger stands of various moisture levels (Welsh and Lind 1988), probably due to the complex structure of older stands (Franklin and Spies 1984, and Franklin et al. 1981) and resulting amenable microclimates. Old stands provide dense litter layers, abundant woody debris, and stratified canopies, which all enhance moisture retention (Pentranka et al. 1994) and limit moisture and temperature variations in the forest floor. Salamander abundance and richness decrease after logging (Bury and Corn 1988, Pough et al. 1987, Enge and Marion 1986, Bury 1983, Bennett et al. 1980, Bury and Martin 1973) because microclimate and cover characteristics, which determine habitat suitability, deleteriously change (Baker 1938).

HABITAT ON THE MONONGAHELA NATIONAL FOREST

CMS occurs in red spruce forest types (*Picea rubens*) with a yellow birch (*Betula alleghaniensis*) component, or in mixed deciduous forest types (Green and Pauley 1987), between 805 m (2641 ft) (Pauley and Pauley 1997) and 1482 m (4860 ft) (Pauley 1999) elevations. Santiago (1999) noted that CMS habitat in the Stuart Knob area of the MNF had relative humidities between 92.5 and 99.9 percent. This range was the most limited of 4 plethodontid species studied. Further, the lower relative humidity limit was 15.9 to 36.2 percent higher than any other sympatric species present.

Known and potential range distributions of CMS populations on the MNF have been delineated on USGS topographic maps by Dr. Thomas K. Pauley of Marshall University, the leading authority on the life history and range distribution of the CMS.

CAUSES OF PAST/CURRENT DECLINE

The extensive logging of spruce around the turn of the century is the most likely cause of decline for this species. Competition from other similar plethodontids, genetic isolation of populations, habitat degradation (e.g., acid deposition), habitat fragmentation, and habitat disturbance all continue to contribute to the limited occurrence of the CMS (Pauley 1980,1991).

FOREST PLAN STANDARDS AND GUIDELINES PERTINENT TO CHEAT MOUNTAIN SALAMANDER

Although the MNF Forest Plan was signed during 1986, several years prior to the federal listing of the CMS, there are standards and guidelines specific to this species.

> Since (CMS) occupied habitat is not continuous and is not easily discernible, an on-the-ground survey for occupancy prior to vegetation and surface disturbance will be conducted. Located colonies will be avoided where possible. Identified colonies may be relocated, but only if techniques currently under study are proven effective. Salamander sites will not be shown on maps.....86

Other pertinent Standards and Guidelines in the Forest Plan include:

MP 5 (8.6% of Forest)

No active vegetation management in the MP.

MP 6.1 (50.5% of Forest)

Five percent of the National Forest lands should ultimately be in old growth stands 166

MP 6.2 (13.8% for Forest)

Trees cut down only to aid in development of dispersed recreation, to enhance public safety, for insect and disease control or to salvage timber and restore areas severely damaged by hurricanes or ice storms.....185

EFFECTS OF CONTINUED IMPLEMENTATION OF THE FOREST PLAN

All management activities, which list potential effects, would have those effects only if done in occupied or potential CMS habitat. All stands proposed for projects are reviewed prior to project implementation to determine if they contain occupied or potential CMS habitat. Potential CMS habitat included in project plans are field surveyed prior to implementation of any vegetative disturbing activities using survey specifications as stated in the CMS Recovery Plan (Pauley 1991). If any CMS are found or if field surveys indicate that the area is high potential habitat, regardless of whether or not any CMS are found during the survey effort, projects are either dropped or designed to avoid CMS. All surveys to date have been completed by Dr. Pauley. If salamanders are found, population areas are delineated in relation to the project area and appropriate buffers applied (minimum of 300 feet).

Based on unsuccessful attempts at relocating populations since inception of the FP this method is no longer deemed an acceptable technique.

Regeneration Harvest

Felled trees and logging equipment can crush CMS when they are not hibernating, even when they are under litter. Clearcutting creates long term drought-like, stressful conditions to salamanders, which could cause desiccation or force escape to underground retreats where food is scarce (Petranka et al. 1994). Because above-ground recovery to hospitable conditions for salamanders could require several years, food scarcity would compromise growth and reproduction and may result in starvation (Petranka et al. 1993). Harvest areas also may become more attractive to predators of CMS. CMS populations could be decimated or fragmented by timber removal, resulting in further genetic isolation. Salamander abundance and richness in the East are affected negatively by logging (Bennett et al. 1980, Blymer and McGinnes 1977, Pough et al. 1987, Ash 1988, Dodd 1991, Buhlmann et al. 1988, and Petranka et al. 1987), and recovery to pre-logging levels is estimated to take 50-70 years (Petranka et al. 1993).

The indirect effects of this activity include soil compaction on skid roads and trails that may eliminate below-ground entry to CMS, forcing them to find other habitat, if available. However, migration to adjoining undisturbed habitat is unlikely because salamanders are territorial. If migration did occur, resident salamanders would repel newcomers (Petranka et al., 1993). There is also some evidence that harvesting results in a lower availability of soft bodied prey, which are a higher quality food item for CMS than the hard-bodied prey found more readily in silviculturally treated stands (Mitchell et. al. 1996, Gabor and Jaeger, 1995).

Because CMS is considered in every proposed regeneration harvest (as previously described), this activity does not occur where it could affect this species. Therefore, there are no direct or indirect effects.

Thinning and Single Tree Selection

Thinning and single tree selection have the same potential direct effects as a Regeneration Harvest (above). A canopy opening created by removing even one tree can increase insolation at the forest floor and create a drier, warmer microclimate in the opening, at least in the short term. The home range of CMS is small and probably similar to (Pauley pers. comm.1999) the 3.0-4.8 m^2 (9.8-15.7 ft^2) home range of the red-backed salamander (Kleeberger and Werner 1982). Home ranges for CMS in the Stuart Knob area of the MNF were approximately 2.0-3.5m^2 (6.6-11.5 ft^2) (Santiago, pers. obser., 1999). If a canopy opening is created in the home range of CMS, the individual or population could be significantly affected by the altered microclimate.

Thinning and single tree selections have the same potential indirect effects as a Regeneration Harvest.

This activity is also not done in areas with CMS, so these potential effects are not realized.

Timber Stand Improvement (TSI)

Felling of small diameter trees has some potential to crush salamanders. Removal of vines and the application of herbicides have no direct effects on CMS. Again, this work is only done in areas where there have been commercial timber sales or there would likely be sales in the future, so CMS habitat and therefore direct effects to the species are avoided.

No indirect effects from TSI work on CMS are anticipated as TSI does not cause soil compaction, nor does it substantially alter the forest canopy or composition.

Prescribed Fire

To date, most of the prescribed burning done on the Forest has been the burning of a few grassy/herbaceous openings for wildlife habitat improvement and training purposes. The MNF has begun to burn understories in oak-hickory forest types, and anticipates this program growing. Because the CMS would not be present in open grassy areas or oak-hickory forest types (Pauley, pers. comm., 1999), there would be no direct or indirect effects.

Firewood Cutting

The MNF permits specify only dead and down trees may be cut for firewood. Because CMS utilize downed woody debris for moist retreat sites (Green and Pauley 1987) and foraging locations (Jaeger, 1979), firewood removal from the forest floor increases the potential for habitat loss and salamander desiccation. Salamanders aggressively defend limited moist retreats under cover objects against competitors (Jaeger, 1979), so individuals displaced by firewood removal probably would not find another favorable cover object in their home range. However, moist, rotting logs are unsuitable for firewood and are not collected by firewood cutters.

Indirect effects of firewood cutting are that removal of wood that is not currently providing retreats eliminates future sources of refugia for new individuals as populations grow, or as old refugia becomes unusable (i.e., through rot, etc). In areas where cover objects are limited, firewood cutting further exacerbates future habitat suitability. Invertebrates that use downed wood for refugia also can be affected negatively by firewood removal, thereby reducing food sources for CMS (Pauley, pers. comm., 1999).

Firewood cutting consists of the removal of about 800 to 1000 cords/year on the entire MNF. Firewood collection occurs principally along open roads, of which there are approximately 538 miles on the MNF (and an additional 152 that are open seasonally). Of the 690 miles of road open yearlong or seasonally, approximately 59 miles are in potential CMS habitat, and only 8 miles of this is open road. Thus the probability of firewood collection affecting CMS is very low, given the limited scope of this activity in CMS habitat.

Gypsy Moth

Past gypsy moth management has been restricted to oak stands. Any future control work would also be limited to oak areas. It is highly unlikely that CMS occur in oak stands (Pauley pers. comm. 1999), so no direct, indirect, or cumulative effects from gypsy moth defoliation or treatment exist.

Road Construction/Reconstruction

Tree removal and heavy equipment operations for road construction directly affect the forest floor and, therefore, have potential to harm or kill salamanders or negatively change their habitat. These activities also may decimate or fragment CMS populations. All the direct effects described under Regeneration Harvest apply to road construction and reconstruction.

Tree removal for road construction has the same potential indirect effects as a Regeneration Harvest (above). In addition, roads create barriers to CMS movement and dispersal. A road constructed through a CMS population will prevent genetic exchange between fragmented populations. Roads present a permanent habitat change, resulting in longer-term effects to habitat suitability than by timber harvesting alone.

Road construction, as with regeneration harvest, occurs only in areas not occupied by CMS, so there would be no direct or indirect effects

Recreation

Because CMS are nocturnal, disturbance from predominantly diurnal recreation, such as hiking, backpacking, hunting, fishing, and mountain biking, has no direct effects on CMS populations. Tree removal for trail or recreational development has similar potential effects as a Regeneration Harvest (above), although any developed recreation projects on the MNF are unlikely in the future. Heavy trail use reduces leaf litter, limiting CMS movement and territory size. Population fragmentation and genetic isolation may result (Pauley pers. comm. 1999). Removal or disturbance of downed wood or rocks by campers would have the same potential effects as Firewood Cutting (above). Limestone use for trail tread fill could increase alkalinity of upper soil layers; effects of alkalinity increases on CMS are unknown (Pauley pers. comm. 1999). Trails located in CMS populations utilize native rock sources to prevent or minimize changes in pH.

Tree removal for trail construction or relocation, or other recreational development can indirectly affect CMS by changing forest floor microclimates and possibly decreasing habitat suitability for CMS (Pauley pers. comm. 1999). Trails create permanent barriers that CMS will not cross; therefore, trails have the same indirect effects described for roads. Very little trail construction is done annually on the MNF and the design of all such projects all are done in accordance with the CMS recovery plan.

Future use of existing trails may increase as more people learn about MNF trails. Eight miles of existing trails occur in CMS habitat, but the trails, themselves, generally are not suitable habitat due to insufficient litter cover and compaction. Thus, continued use of these trails will not affect the species, assuming trails are not widened or re-routed. If use significantly increases on trails in potential CMS habitat that now have enough litter and are not too compacted to support CMS, additional destruction of potential habitat and possible population fragmentation could occur.

Wildlife Habitat Improvements

Tree removal for wildlife opening and savanna construction has similar potential direct effects as Regeneration Harvest. Since wildlife openings are created from log landings from timber sales and savannas are created through commercial timber sales, these activities would not occur in CMS habitat.

Fisheries Improvements

Fisheries management includes stream habitat enhancements, such as stream liming, large wood placement, and erosion control measures. Tree felling to provide large woody debris (LWD) has similar potential direct and indirect effects as a Regeneration Harvest, albeit at a much smaller scale and effects associated with logging equipment and tree removal would be unlikely as downed trees are left in the immediate area. Cutting trees create temporary canopy openings for LWD. While usually only one tree is cut per 75 to 100 ft length of stream edge, a canopy opening along a stream edge may affect CMS microhabitat. CMS has been observed along the streambank at Blackwater Falls and in the riparian area of the Shavers Fork River (Pauley, pers. comm. 1999).

Since nearly all fisheries habitat improvement projects are funded by KV dollars generated from timber sales, the majority of this work would be done in previously cleared areas associated with timber sales or designed to avoid potential or occupied CMS habitat. Fisheries improvement activities proposed beyond the scope of KV projects are limited in number and avoid potential or occupied CMS habitat. Consequently, the potential for direct, indirect, or cumulative negative effects to this species are extremely unlikely, and therefore discountable.

Range

Grazing activities on range allotments would have no direct, indirect, or cumulative effects on CMS because these allotments provide unsuitable habitat. One high elevation allotment has a population of CMS just outside its boundary, but the allotment will not be expanded beyond its current boundaries in the future, so this CMS population will not be affected.

Mineral Activity

Clearing trees for gas field development has the same potential effects as a Regeneration Harvest (above). Seismic exploration is another activity that is sometimes conducted on National Forest lands. No shot holes are permitted in potential or occupied CMS habitat. In limited instances listening devices known as geophones have been placed in CMS habitat. Because geophones and cables are placed on the ground surface with little or no ground or vegetative disturbance, cover and other habitat elements are not removed by this activity. Thus the probability of seismic activity affecting CMS is very low.

Indirect effects would be similar to those for Regeneration Harvest and Road Construction, since these activities are associated with gas development.

Summary of Cumulative Effects

The current levels of CMS populations are a result of the extensive logging of spruce habitat in the early 1900's. With approximately 88 percent of CMS populations within the MNF boundary (Pauley pers. comm. 1999), timber harvesting and other activities outside of the MNF will have limited cumulative effects on CMS populations. Because all activities except firewood cutting, mineral activity and existing recreation use are avoided in occupied and high potential CMS habitat on the MNF, there also should be no cumulative effects on this species within the Forest boundaries due to continued implementation of the Forest Plan. Effects from firewood cutting, mineral activity and existing recreation use are minimal due to their small scope within CMS habitat and are considered discountable.

Summary of Potential Effects to Cheat Mountain salamander

Potential beneficial effects are:

1. Continuing to provide undisturbed habitat for CMS.

2. Apply mitigations stated in the CMS recovery plan.

Potential adverse effects are:

1. Minimal effects from firewood and recreation activities.

DETERMINATION

MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for regeneration harvesting, thinning and single tree selection, timber stand improvement, firewood cutting, road construction/reconstruction, recreation, wildlife and fisheries habitat improvements, and mineral activity based on the continuing practice of avoiding lands containing occupied CMS habitat or high potential habitat in any project design. Therefore, potential effects of these activities will not be realized in areas where CMS occur. A NO EFFECT determination is made for prescribed fire, gypsy moth, and range.

MEASURES TO MINIMIZE POTENTIAL ADVERSE EFFECTS TO CHEAT MOUNTAIN SALAMANDER

1. Continue to follow the current policy of avoiding activities in CMS habitat.

2. Continue to implement actions in the CMS Recovery Plan.

3. Revise language in FP (p. 86) to reflect current knowledge regarding relocation of this species and mapping of populations.

INDIANA BAT

Indiana bat, Myotis *sodalis*, (IB) was listed as endangered on March 11, 1967. A USFWS Recovery Plan was developed and signed 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 being prepared.

DISTRIBUTION

IB is distributed throughout the eastern US, from Oklahoma, Iowa, and Wisconsin, east to Vermont and south to northwestern Florida (Romme et al. 1995). During winter, IB restrict themselves primarily to karst areas of east-central U.S. More than 85% of the range-wide IB population occupies 9 Priority One hibernacula (Priority One hibernacula are defined as caves that have an annual IB populations >30,000 since 1960), all of which are in Indiana, Kentucky, and Missouri. Priority Two hibernacula (IB populations >500 but < 30,000 since 1960) occur in the aforementioned states plus Arkansas, Illinois, New York, Ohio, Tennessee, Virginia and West Virginia. Hibernacula with IB populations of <500 or records of single hibernating individuals are classified as Priority Three hibernacula. They occur in all aforementioned states plus Alabama, Connecticut, Florida, Georgia, Iowa, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Vermont, and Wisconsin (USFWS 1997).

Hibernacula monitoring shows IB populations are decreasing in portions of their core range (USFWS 1996), but not in West Virginia, where estimated populations have been increasing since the early 80's (Endangered Species Federal Assistance Performance Reports, WVDNR 1981-2000). Most significant caves are gated or fenced, which has protected IB populations and likely has been responsible for their increases (Wallace, 1999). In the last decade, WV has seen a 45% increase in the number of hibernating IB (Wallace pers. comm. 1999) with the total IB in the state at approximately 10,658 (Stihler and Wallace 1999). This represents 3% of the entire hibernating IB population range-wide.

Hibernating IB have been observed in many West Virginia caves, but the colonies typically are not large. In most years, approximately 26 West Virginia caves provide adequate IB winter hibernacula; 5 of those caves are on the MNF. IB populations in West Virginia caves range from a single IB observation to populations over 8,000. Historic records list 6 additional IB caves, but IB no longer inhabits those caves (Stihler per. comm. 1997).

West Virginia is within IB's eastern maternity range, but not within its core, and it does not have confirmed maternity colonies. The majority of known maternity colonies are in states west of WV, such as Ohio and Indiana. There are maternity colonies in some eastern states, such as New Jersey, Pennsylvania, and Virginia. Stihler (pers. comm. 2000) speculates that the IB hibernating in the mountain regions of WV are most likely traveling to western WV or states west of WV to raise their young due to warmer nighttime temperatures found there.

REPRODUCTION

The annual life history of the IB is illustrated in Figure 4. Females store sperm through the winter and become pregnant via delayed fertilization soon after hibernacula emergence, generally late March or early April. Females emerge first, and most winter populations leave the cave by early May.

Young females can mate their first autumn and have offspring the following year; males are sexually mature their second year. Each female gives birth to a single offspring in late June or early July. Summering females cluster together forming maternity colonies until their young can forage. Young become volant in approximately one month, and by mid August maternity colonies begin to disperse.

FOOD HABITS

IB forage nightly for terrestrial moths and aquatic insects in riparian as well as upland forests. Prey selection reflects the foraging environment (Romme et al. 1995). Fecal material analysis done in Indiana showed Lepidoptera (moths) and Coleoptera (beetles) are the majority of IB diet (Brack 1983). Access to water is essential when bats forage.

GENERAL HABITAT CHARACTERISTICS

Summer Roosting Habitat

Romme et al. (1995) presents 5 variables that determine roosting habitat (percent canopy cover, mean diameter of overstory trees, density of potential live roost trees >8.7 inches DBH, density of snags >8.7 inches DBH, and percent understory [or understory crown density]) and describes the values of these variables which make the most suitable IB habitat. The optimal canopy cover for roosting IB is 60-80%. The higher the mean diameter of overstory trees, the more suitable the area is for roosting. Certain species (such as silver maple, hickories and some oaks) with diameters exceeding 8.7 inches are more likely to provide future roost trees. The abundance of snags indicates current roosting value, so the more snags the better. At least 35 snags per acre is optimal. The percent of understory cover indicates how accessible the roost trees are to the bats. The lower percentage, the better the access to roost sites.

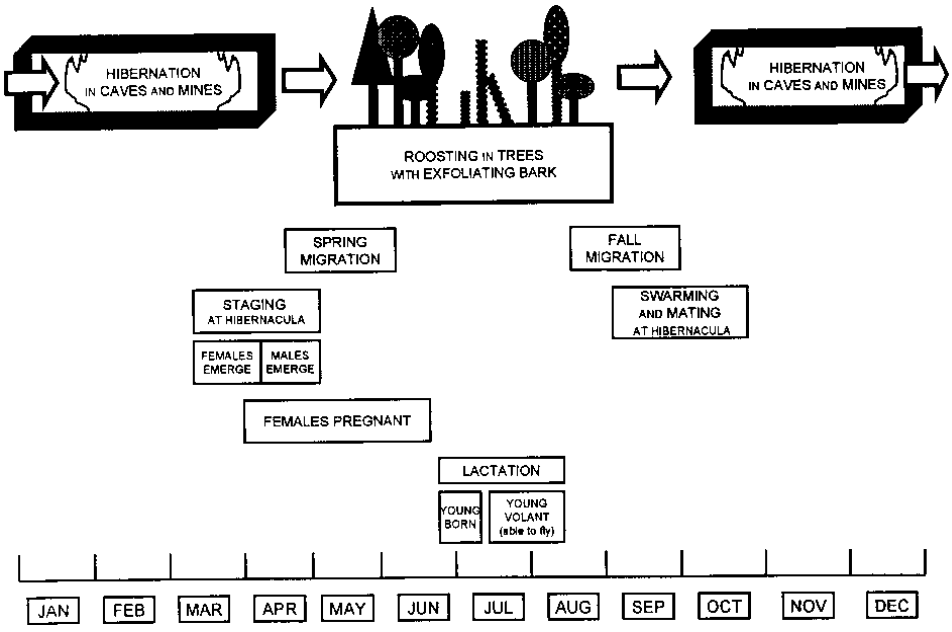


Figure 4. **Life history of the Indiana bat**

Tree structure, specifically the availability of exfoliating bark with roost space underneath, is a critical characteristic for roost trees. Within its range, IB's existence may be governed by availability of natural roost structures. Roost site suitability is determined by 1) tree condition (dead vs. living), 2) loose bark availability, 3) solar exposure and relative location to other trees, and 4) spatial relationship to water and foraging areas (USFWS 1999). 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 (McKenzie 1999).

IB have been found to show strong fidelity to roost areas, however individual roost trees are naturally ephemeral, and may be available for a short period of time (Gardner et al. 1991, Humphrey et al. 1977). Individual roost trees are suitable until all bark sloughs off or the tree falls to the ground. Tree removal does not discourage IB from using dead trees nearby as roosts; and in fact may make them more attractive by allowing more warming by solar radiation (USFWS 1999). Maternity colonies typically use multiple roosts – at least 1 "primary" roost used by most bats during summer, and a number of "secondary" roosts used intermittently and by fewer bats. Thus, some IB maternity colonies may use more than a dozen roosts (USFWS 1996). IB use isolated trees in openings as roost trees (Kurta et al, 1993), and they may switch between shaded and unshaded roost trees depending on weather conditions (Callahan et al, 1997; Kurta et al, 1996) and physiological requirements associated with thermal regulation.

Summer Foraging Habitat

IB forage nightly for terrestrial moths and aquatic insects, primarily in upland forests and riparian woodlands. Prey selection reflects the foraging environment (Romme et al. 1995). While summer needs are not well understood (USFWS 1997), IB prefer to forage within upper forest canopy layers where overstory canopy cover ranges from 50-70%. Foraging habitat suitability declines slightly when canopy cover exceeds 70% or is less than 50% (Romme et al. 1995). IB also are known to forage along forest edges, in early successional areas, and along strips of trees extending into more open habitat, but drinking water must be available near foraging areas (Romme et. al. 1995). Large open pastures or croplands, large areas with <10% canopy cover, and stands with large unbroken expanses of young (2-5-in dbh), even-aged forests are avoided or are rarely used for IB foraging (Romme et al. 1995).

Fall Swarming Habitat

IB begin swarming as early as August and through October or November, depending upon local weather conditions. Swarming entails congregating around hibernacula prior to hibernation, flying into and out of cave entrances from dusk to dawn (Kiser and Elliot 1996). This is a biologically important period because during this time bats mate and replenish fat reserves prior to hibernating (USFWS 1983). Males generally remain active longer during fall swarming than females (USFWS 1983), presumably to mate with as many females as possible.

Fall night roosting may occur inside the cave or in trees near the hibernacula. In Kentucky, Kiser and Elliott (1996) found IB males roosting primarily in dead trees on upper slopes and ridgetops within 1.5 miles (or 2.4 km) of the hibernacula.

Hibernacula

IB hibernacula are classified as Priority One, Two or Three, as described in the Distribution section. Hellhole, a privately owned cave in Pendleton County, is the only West Virginia cave currently designated Critical IB Habitat (Priority Two) (USFWS 1996); it lies within the MNF's Proclamation Boundary, but on private land approximately 1 mile from National Forest land.

IB typically hibernate in clusters from October - April, depending upon local weather conditions. Roost site relative humidity during hibernation usually is >74% but below saturation (Humphrey 1978). IB hibernation has been observed at relative humidity of 54% (Myers, 1964). Humidity may be important to hibernation success (Thomas and Cloutier, 1992).

HABITAT ON THE MONONGAHELA NATIONAL FOREST

Summer Roosting Habitat

Potential roosting habitat, both maternity and nonmaternity, is widely available as the MNF is 96% forested (872,800 acres) with 63% of that (549,860 acres) being >60 years old. Field observations of >60 year old areas suggest most of these stands have closed or nearly-closed canopies, over the 60-80% that is optimal. As aging continues, however, canopy gaps from dying trees will become more prevalent, reducing the overall canopy cover. Given the average growth rates on the MNF, the stands that are over 60 years old, most likely have a mean diameter of around 11 inches DBH, well over 8.7 inches, needed for quality roosting habitat. Trees exhibiting roosting characteristics, such as shagbark and bitternut hickory, red and white oak, sugar maple, white and green ash, and sassafras, are plentiful throughout the Forest. Snag abundance will not reach optimum levels on the MNF for several years, when the trees begin reaching the end of their life span. Field observations indicate that the percentage of understory coverage is highly variable across the MNF.

Despite extensive summer surveys throughout West Virginia, especially in and around the MNF (Appendix 6), IB maternity roosts have not been found. Presumably, reproductive female bats are more constrained by thermoregulatory and energy needs than are males and nonreproductive females. Constraints imposed on reproductive females may limit their geographic distribution relative to other bats. Such constraints likely increase with latitude and elevation (Cryan 2000). At this time, it has not been determined where the females that winter in or near the MNF caves are traveling to raise their young, although it is likely that they are traveling west of the Forest because higher temperatures found there may potentially improve reproductive success (USFWS 1999). During the last decade, of the over 3700 total bats captured in and around the MNF, none have been lactating or pregnant IB females, or IB females with young (see Appendix 6 for survey details). MNF nighttime temperatures on most of the Forest are thought to be too cold to support maternity colonies (Stihler and Tolin, pers. comm. 1999).

To date, the best evidence of potential maternity activity on the Forest is a discovery of a juvenile male IB on August 5, 1999 while examining bridges in a project area (a practice incorporated into survey methods starting in 1999). This was the first known capture of a juvenile on the MNF during the summer period. Follow up surveys at the bridge where this bat was discovered and adjacent forested areas were conducted in July of 2000. However, no IB were captured or otherwise discovered.

It is possible that this juvenile male bat was already migrating from a maternity site off the MNF to a hibernaculum on or near the Forest (Stihler and Tolin pers. comm. 1999). This capture was close to the time of the year when swarming normally begins (mid August). Experience suggests that during years with climatic conditions similar to those experienced in 1999 (exceptionally warm and dry) IB give birth early and the young develop more quickly. Therefore, the young become volant sooner and ready to journey to the swarming area earlier in the year. Data also suggest that males typically arrive early at hibernacula (Stihler, pers. comm. 1999).

Also in early August 1999 an adult male IB was captured off the Forest in a mist net in Clay County, WV, well beyond 5 miles from a hibernaculum, and in July 2000, an adult male was captured slightly beyond 5 miles from a hibernaculum. These males were most likely on their way to, or between, hibernacula.

While no female IB or known maternity colonies have been found during the summer within the MNF proclamation boundary or anywhere in WV, male IB have been in the proximity of the hibernacula during this time period. In 1995, Stihler reported the first record of summer IB in WV, when he surveyed bats at Big Springs Cave several times a month from June through November of that year. He documented IB captures of male IB at this hibernaculum beginning in June, and female IB starting in mid-August. In that 1995 study, Stihler caught a total of 69 IB. Stihler (1997) found that IB males foraged and day roosted near hibernacula (within 3.5 miles, or 5.6 km) throughout summer. He observed that these IB males often switched roost trees from day to day, roosting in trees near ridge tops. Based on Stihler's work, a 5 mile zone around hibernacula is considered habitat for those IB that stay around the caves in the summer, mostly males as far as we know. This new information has been incorporated into management practices on the Forest, even though it is not specified in the Forest Plan. The Mon provides 203,235 acres of habitat (28% of the Forest) within these 5 miles zones (See figure 5). Another 513,247 acres are in private ownership. The NF habitat in these 5 mile zones is representative of the whole Forest, namely mostly forested areas over 60 years old and having dense canopies.

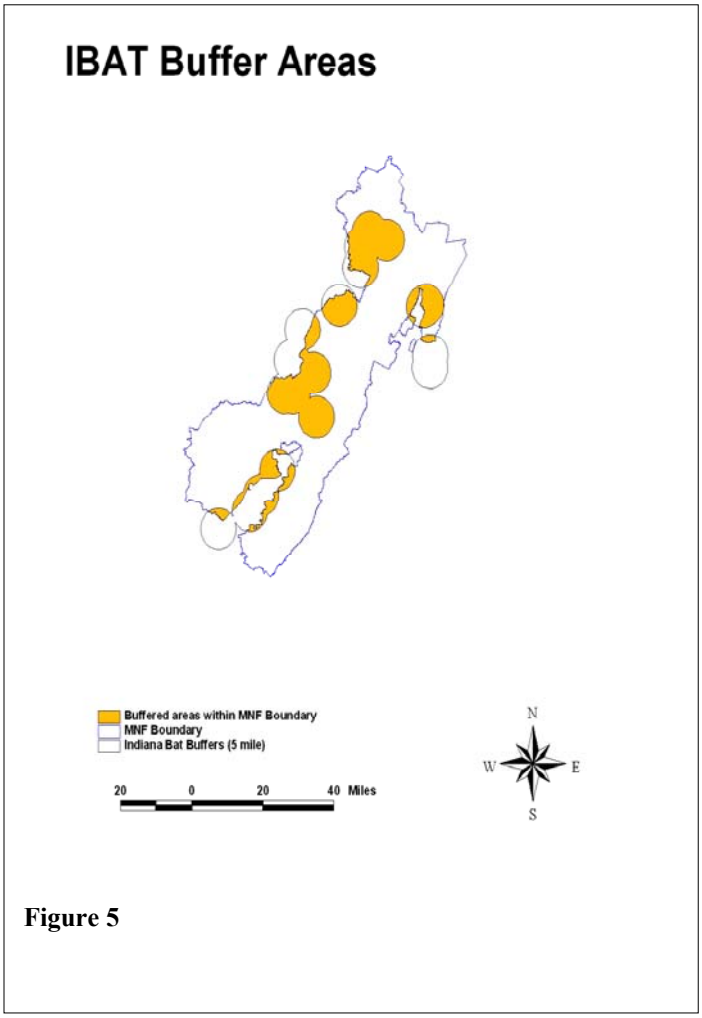


Figure 5

Summer Foraging Habitat

Based upon a review of available forest data A large amount of the Forest is above optimal canopy closure for IB foraging habitat, but the majority of forested conditions does make most of the Forest potential habitat. Summer foraging habitat in WV has been discovered only recently and is concentrated around hibernacula. Male IB were found using habitat around Big Springs Cave in summer and fall Stihler (1996).

Fall Swarming Habitat

The MNF provides approximately 203,235 acres of swarming habitat within 5 miles of known hibernacula, and as described earlier in this document, most of which is forested.

Radio telemetry studies conducted near Big Springs Cave on the Fernow Experimental Forest (located within the MNF) in 1997 provide local data about roost trees and foraging habitats used by IB during fall swarming. Although a limited sample (N=4), bats appeared to forage primarily in wooded habitats including riparian zones. Roosts were usually in dead trees, dead portions of live trees, or in live shagbark hickories. Some species that were used as day roosts during this study were, larger-diameter (>10 inches dbh) black cherry, shagbark hickory, slippery elm, white ash, and yellow poplar trees. Fall night roosting may occur inside the cave or in trees near the hibernacula. This study also showed IB stay within about 3.5 miles of the hibernacula during fall swarming (Stihler 1998).

Hibernacula

All known Indiana bat hibernacula in West Virginia are located in 9 eastern counties. The greatest numbers of IB hibernate in Pendleton County, primarily because Hellhole, West Virginia's largest hibernaculum occurs there. Use of Hellhole has been on a steady increase for the past 16 years. In 1983-84, this cave wintered only 210 IB, and the numbers have increased yearly, as shown in Table 4. In March 1999, this cave held 8,548 of the state's estimated 10,658 IB population. . Hellhole is the only West Virginia hibernaculum designated as Critical IB habitat - Priority Two; all others in the state are Priority Three with <500 bats each. Wintering populations from 1-210 individuals have been recorded in the 5 MNF caves.

The majority of West Virginia's known Indiana bat hibernacula are closed to public use. Eleven hibernacula, including Hellhole, are within the MNF Proclamation Boundary, but only 3 (Big Springs Cave, Cave Hollow/Arbogast Cave, and Two-Lick Run Cave) have all or most of their entrances on MNF land. Cave Hollow/Arbogast Cave is gated with a year-round closure order. Two-Lick Run Cave is signed as closed and Big Springs Cave is gated from September 1 to May 15. Areas around these caves, and potentially others as well, are used by IB for swarming.

Table 4. Indiana Bat Winter Surveys in the Six Caves With the Highest Populations in West Virginia

Year	Hellhole	Big Springs	Martha's	Cave Hollow Arbogast	Snedegar's	Cornwell
1980			23			
1981						41
1982		150		2		
1983						
1984	210	77	74	3		
1985						
1986	3330		100			
1987		82	126	24		9[4]
1988				138		
1989	5143	77				
1990			130			95
1991	5470	112		86		
1992			210			90
1993	5618	176		84		
1994			241		113	115
1995	6808	254		135		
1996		183	285		120	101
1997	10437[1]	200		142		
1998			154[3]		107	80
1999	8548[2]	210		124		
2000			142		140	117[5]

[1]**WVDNR personnel feel that the numbers of IB were over-estimated in 1997. Although IB and little brown bats (Myotis lucifugus) usually form species-specific clusters, they cluster together in the Bat Room making it easy to over-estimate the number of IB. The count in the Bat Room for 1999 was lower than noted in 1997 survey, but it does not indicate a decline (Stihler and Wallace 1999)**

[2]**The area known as Tina Hall, a site containing approximately 500 IB in 1997, was not surveyed in 1999 (Stihler and Wallace 1999).**

[3] **Only survey front portion of cave (Stihler et. al. 2000)**

[4]**Decline attributed to flooding in the cave.**

[5]**Not a complete survey.**

CAUSES OF PAST/ CURRENT DECLINES

Human disturbance of hibernating bats and vandalism are two primary factors contributing to IB decline. When aroused, bats use up stored fat needed to support them until spring when insect prey is again available. A bat can expend as much energy during one disturbance as during 2-3 weeks of hibernation. Thus, if disturbed often, hibernating bats may starve before spring (Harvey 1992). Vandalism has resulted in deliberate bat colony destruction simply because these animals often are viewed as nuisances or human health threats (USFWS 1996).

Other causes of IB decline are the same as those described for VBEB, and include natural disasters, habitat alteration, chemical contamination, historic collecting and handling, poorly-designed and installed cave gates, cave commercialization, insecticides, and natural predators.

IB maternity colony disturbance also reduces populations. Flightless newborn bat pups are vulnerable and cannot escape disturbance, and with sufficient disturbance, adult bats may abandon the maternity area and the young.

FOREST PLAN STANDARDS AND GUIDELINES PERTINENT TO THE INDIANA BAT

General Forest-wide *Page*

Most caves on the Forest will be available for public recreation use, subject to control measures necessary to protect cave formations and endangered species. Some caves will be closed to public use to protect endangered species. Public entry into caves may be prohibited or restricted if providing significant habitat for T& E or unique wildlife species sensitive to disturbance by humans.....67

Forest-wide direction specific to Indiana bats or to caves, which protects both VBEB and IB hibernacula

Caves and cave environments will be protected from damage resulting from surface activities.....67

Twenty-five acres is the maximum size of clearcuts, seed tree cuts, or shelterwood removal cuts under normal circumstances; openings will be spaced 1/8 mile apart and separated by manageable stands of trees (opening defined as cutover area within which the vegetation is less than 20% of the height of the surrounding vegetation).....77

Identified nursery colonies, hibernation sites, and corridors will be managed under zoological area standards. Forage habitat will be managed under Forest-wide riparian area standards 86

Foraging habitat includes riparian land and vegetation approximately 100 feet wide along both sides of streams that are at least 30 feet wide as of June 15. Included area consists of aquatic ecosystems, floodplains, riparian ecosystems, and wetlands.....87a

The following guidelines will apply:

-Protect all standing dead trees, except for public safety; in trailside areas, dead and down trees may be removed 87a
-Protect living loose bark trees such as hickories, elms, oaks, and sycamores.....87a
-Protect hollow trees and den trees whether living or dead.....87a
-Vegetative manipulation, in the form of patch clearcutting (5 acres or less), may be accomplished to perpetuate or establish desirable tree species or composition in the riparian areas.....88
-Major occupancy developments in riparian areas will not be encouraged but considered on a case-by-case basis through the EA process.....88
-Extensive use of pesticides in foraging habitat should be avoided 88

Individual MPs also protect IB and their habitat. Each MP has management objectives and specific standards and guidelines.

MP 2 (2.5% of Forest)

Achieve dispersed habitat elements: permanent openings (5%), conifer component (5-49%) and snags or cull trees (3-5/acre)..... 117

Have trees reach certain size classes before harvest; between 22-28 inches for most species groups 120

Uneven aged management is to be the primary silvicultural system.....121

MP 3 (22% of Forest)

Maintain vegetative diversity: openings 5%, old growth 5%, conifer 5-49%, snags and culls 3-5/acre, seedling stands 10-25%, pole stands 15-38%, saw timber 38-75%.....129

When balanced age class is achieved, rotation ages would be over 100 for most tree species groups 132

Have trees reach certain size classes before harvest; between 22-28" for most species133

MP 5 (8.6% of Forest)

No active vegetative management in this MP.

MP 6.1 (50.5% of Forest)

Strive for 5% openings, 5% old growth, 5-25%conifer.....166

Retain all snags except for public safety or visual management purposes.....167

Cull trees will be protected; retain at least 5 culls per acre when thinning, culls may be girdled to produce snags in certain instances.....168

Protect culls and snags from firewood collection 168

When balanced age class is achieved, rotation ages are 120 yrs. for black cherry, 200 yrs. for oak- hickory and mixed hardwood, and 80-100 yrs. for conifers 172

Frequency of entry is restricted to one major project (or equivalent) per 1500-acre area every ten years. Minor projects can occur at any time 173

Regeneration cutting is limited to 8% or less per entry (10 yr) period.....174

MP 6.2 (13.8% of forest)

Trees cut down only to aid in development of dispersed recreation, to enhance public safety, for insect and disease control, or to salvage timber and restore areas severely damaged by hurricanes or ice storm 185

Wildlife habitat management for T&E species is permitted.....189a

The Forest Plan also provides direction for special areas, called Zoological Areas, that function as endangered species habitat. Important IB habitats have specific standards and guidelines listed below; these are in addition to Forest-wide and MP directions:

-Project activities in these areas require consultation with USFWS.

-Cave entrances will be signed and posted against entry. Locations not published for distribution to the public, no directional signs on roads or trails will be posted directing people to these caves.

-Special areas for protection of endangered bats are defined as 200 feet in radius from the entrances to inhabited caves, 200 feet in radius around a maternity colony of Indiana bats as long as the site is used, a forested travel corridor 330 feet wide between the cave entrances and foraging areas.

-Avoid pesticide use in these management areas.

-No new facilities will be constructed for recreational use.

-Vegetative treatments may be undertaken if coordinated with bat habitat requirements in the Opportunity Area.

-In travel corridors, the objective is to maintain or create an unbroken forest canopy.

-Public entrance into caves used as hibernacula for Indiana bats will be prohibited from September 1 to May 15.

-Entry into caves during the closed periods for scientific study and observation will be permitted by written approval of the Forest Supervisor and permit from the USFWS or equivalent.

-Gates installed at cave entrances will allow free entry and exit by bats and not restrict airflow.

-Gates will be maintained on a schedule based on past history of problems.

-Controlling forest fires will be a high priority to prevent bat asphyxiation or significant changes in vegetative cover.

-Prohibit special uses in the travel corridor that would be adverse to bat use.

-Surface occupancy will not be permitted for mineral operations on US minerals. When minerals are privately owned, consultation with the USFWS will be undertaken to minimize adverse effects on habitat.

-Acquiring any cave used by endangered bats inside the proclamation boundary will be high priority.

-Restrictions are placed on dynamiting during maternity or hibernation periods that could create a severe stress on bats.

-Transportation or utility routes should avoid the area.

-Prohibit placement of new utilities or roads across areas without assessment.

EFFECTS OF CONTINUED IMPLEMENTATION OF THE FOREST PLAN

The following effects potentially apply to the entire MNF, but habitat and direct bat impacts increase as activities approach hibernacula because IB use hibernacula from fall through spring, and some males use these in the summer. Based on recent information not known at the time of the Forest Plan, there are two areas that now receive a higher level of concern when managing. One area is the 5 mile radius around each hibernaculum and the other is the 2 mile radius around any maternity site, which is the area considered by researchers to be utilized by maternity colonies. Since maternity colonies on the MNF have not been found the latter has not been applied, although a similar radius was set up around the capture site of the juvenile male IB caught in 1999. Such a radius will be applied around areas where juveniles or lactating females are found if a maternity site cannot be determined. This radius will remain in place for a minimum of three years during which time the area will continue to be monitored for IB activity. If subsequent data confirms the need for further protection this radius will be maintained. However, potential maternity roosting habitat can be addressed. The general forest area (or potential maternity roosting habitat) and the 5 mile zones will be analyzed in terms of effects. Evidence of maternity use and other summer foraging use on the MNF will continue to be sought by summer mist netting, as coordinated with USFWS.

Regeneration Harvest

Direct Effects:

Regeneration harvests would not directly, indirectly, or cumulatively affect hibernating IB because the Forest Plan prohibits harvesting within 200 ft of cave entrances. During non-hibernation periods however, tree cutting can potentially directly harm IB. Felling a tree that harbors a roosting IB may kill the bat if it does not fly in response to the disturbance, or it may cause a mother to abandon its young. If forced to leave a roost tree during daytime, bats are more vulnerable to predation.

The capture of the male juvenile bat in August 1999 is the only evidence that suggests nearby maternity activity and it indicates that there is some chance of directly harming a bat during this most vulnerable period. Despite the fact that this single bat find does not represent a maternity colony (as defined by the draft IB Recovery Plan), the MNF suspended all tree felling activity within 2 miles of the capture site based on discussions with James Gardner who feels that two miles is the radius for foraging distances from maternity sites (Gardner pers. comm. 1999). This suspension remained in place until after November 15, the date by which IB are in hibernation (USFWS 1999).

We believe the chance of harming IB is low based on the limited evidence of a maternity colony to come out of all the survey work that has been done (Appendix 6) which indicates that the majority of IB on the Forest are most likely volant. Also the amount of the Forest harvested each year is so small that the chance of harvesting occurring where there are vulnerable bats is low. Any acres that have been harvested in the last 4 years have been surveyed for IB prior to implementation. This mist netting has been done in coordination with USFWS and WVDNR using Recovery Plan protocols to determine IB abundance. These summer period surveys have been widespread across the Forest and resulted in the capture of many bat species and individuals (see Appendix 6).

In addition to surveys of individual project areas, MNF personnel began in early 1998, to develop an IB predictive tool to identify the areas with the best potential habitat for IB use. This tool predicted that the warmer, drier, oak-hickory, ridge and valley section in the eastern MNF has the highest potential IB habitat. The combination of warmer temperatures, greatest numbers of preferred shagbark hickory and oak roost trees, and expected greater insect abundance for bat forage all elevate habitat potential. MNF personnel used this tool to direct bat survey efforts (in addition to survey work for projects) conducted on the MNF in the summers of 1998 and 1999.

In all these survey efforts, only two adult IB males and one juvenile IB male have been captured on or near the MNF. This indicates low numbers of IB on the Forest and that the greatest use of the forest is by male IB.

Mist netting has been used in all surveys on the MNF, being the protocol specified in the revised draft IB recovery plan. Although mist netting has some limitations, it is still considered by the IB recovery team to be the most reliable method for bat survey. Detecting bats through Anabat technology has enough serious limitations that it is not the preferred stand alone survey method.

The problem with relying on surveys to indicate IB use of the Forest is that this species, as opposed to many TE species, is highly mobile. Therefore, surveying an area may not reveal IB use but they could move in at a later time. Through complying with current laws and regulations, it takes several years from the inception of a FS project (when surveys would be done to assess any effects) to the time when implementation is completed on the ground, there is a risk that bats will move into an area that was “cleared” by survey work before implementation began. Also the fact that as the population increases in WV, (as shown by the recent several fold increase in the bats occupying Hellhole) the chances increase year after year that bats may move into previously unoccupied territory. Therefore, the chance of harming an IB in the general forest area is not discountable.

Within the 5 mile zones from hibernacula, the Forest assumes presence of IB. This area is treated with caution and all large scale felling activities, such as any regeneration harvest, are done during hibernation periods (November 15-April 1) and small scale tree removal (such as hazard tree removal and trail work) is avoided. This results in discountable effect.

Indirect Effects:
Indirect effects on IB habitat are minor because there is plenty of roost trees available on and near the Forest indicated by the following facts:

1. Within timber sale cutting units snags and culls are usually left standing. The most recent sales also leave all shagbark hickory, a preferred roost tree species for IB.
2. The MNF contains a large number of acres with potential roosting habitat. Well over 500,000 acres of the MNF currently provides potential habitat.
3. There are available forested lands all around the MNF, with WV being 79% forested.
4. Regeneration harvest occurs on only approximately 1,176 acres on the MNF annually.

Indirect effects on IB from clearcutting result from the canopy being reduced to <10%. Canopy reduction to this extent reduces foraging suitability, but may provide more foraging habitat diversity since the MNF contains mostly closed canopy forests. Clearcutting also reduces potential roost tree numbers within the cutting units. Residual trees in these units (e.g., culls, snags, den/cavity trees, leave clumps) still provide potential IB roost and/or maternity sites. Residual trees receiving increased solar radiation become more desirable as potential maternity roosts, and the regenerating forest provides additional varieties and numbers of insect prey.

Alternative regeneration methods, such as two-aged, shelterwood, and seed-tree cuts, leave more potential roost trees and maternity trees per acre than regeneration harvests. Canopy cover is reduced to 10-50%, which still reduces foraging suitability. Group selection harvests (0.25 - 2 acres) normally remove all trees in the group, and therefore has the same effect as clearcutting but on a smaller scale, often the same scale as natural events such as pockets of wind throw or insect outbreaks.

Although alternative regeneration reduces potential roost tree numbers, it may enhance suitability of residual trees because many preferred roost-tree species (e.g., hickory, oak) are shade intolerant, and require substantial direct light to become dominant or co-dominant trees. Further, regeneration of shade intolerant roost trees is possible only when stands are opened up significantly; regeneration harvests can help ensure these tree species continue to be available for IB use in future stands. Tree removal in a stand does not discourage IB from using remaining suitable roost trees within that stand, as evidenced by MacGregor's (1997) find of Indiana bats roosting in shelterwood cuts in Kentucky.

These indirect effects will be discountable in the general forest area due to the very low IB use of these areas and the low amount of harvesting each year.

Within the 5mile zone, the FS carefully plans any activity to ensure adequate habitat is available after the project is completed. The habitat currently available in these zones, as described previously, is a more than adequate amount for IB. Any regeneration project proposed for these areas would be small enough to ensure ample habitat remains for roosting and foraging. On any project in these zones (other than very small scale), the FS will consult with USFWS.

Thinning and Single Tree Selection

Thinning and single tree selection will not directly, indirectly, or cumulatively affect hibernating IB, because the Forest Plan prohibits harvesting within 200 ft of cave entrances. Potential thinning and single tree selection direct effects on IB during non-hibernation periods are the same as those described for regeneration harvesting.

Except for removing potential roost trees, indirect effects of thinning and single tree selection generally benefit IB. Opening up the canopy cover improves foraging as well as roosting conditions. However, these effects are short-term, because canopy closure occurs in approximately 5 - 10 years after most thinning or selection cutting. A more long-term effect of thinning and single tree selection is increased residual growth, creating larger diameter and more suitable roost trees. Damage to residual trees during felling can improve the roosting quality and quantity of residual trees; cavities, dens, and crevices are more likely to develop due to resulting pathogen and insect attack at the injury point.

Selection cutting could negatively affect habitat long term by enhancing forest succession to stands of shade-tolerant tree species, which typically are not preferred IB roost trees. Thinning and selection cuts have occurred on approximately 2,636 acres (0.3% of MNF lands) and 243 acres (0.03% of MNF lands) respectfully on an annual basis over the 12 years from 1987-1998. These cutting levels are not anticipated to change dramatically in the future. Therefore, potential impacts, positive or negative, from these activities are very minor.

Timber Stand Improvement

TSI work would not directly, indirectly, or cumulatively affect hibernating IB because TSI work is not allowed within 200 feet of IB hibernacula.

During non-hibernation periods, TSI direct effects are discountable because only small trees (not roost size) generally are cut during TSI, and often trees are girdled and left standing.

TSI would indirectly increase IB habitat suitability. Shade intolerant tree species are favored, so more preferred roost-tree species survive in the long term. TSI also opens up stands, thereby improving foraging conditions. Killing standing trees by girdling them, or using herbicide, creates snags, which may be used as roost trees. Again, given that the 10 year annual average for TSI work from 1987 through 1996 was 941 acres (0.1% of MNF lands), any impact from these activities is very minor.

Prescribed Fire

Prescribed burning has primarily occurred in open or brushy areas, such as range allotments or wildlife openings. Use of understory burning to stimulate hard mast regeneration is on the increase, especially in oak-hickory forest types that are fire dependent, but is not likely to exceed a few hundred acres per year. Prescribed fire objectives may include removal of some overstory vegetation, but do not include killing a large percentage of trees that meet roost tree standards. Burns are often planned for the spring or fall and take less than a day to complete. Because of the low number of acres involved and the fact that most burns occur when IB are volant, the potential for harm to an individual bat is minimal.

If burning occurs during the hibernation period, IB will most likely not be affected because burning is not permitted around or near known hibernacula. However, certain unpredictable weather conditions may result in smoke entering the cave environment, causing harm to hibernating bats. The chance of harm from prescribed fire, although minimal, is not discountable.

IB forage along forest edges and in small openings. Consequently, IB foraging habitat can improve when small open or brushy habitat is burned. Resulting new lush vegetative growth supports greater biodiversity and numbers of insect prey. Understory burning also promotes shade-intolerant tree species that provide future potential preferred roost sites.

Firewood Cutting

Firewood permits are issued for dead and downed trees or tree tops/slash from closed timber harvest areas and along roads. IB are not known to utilize dead and downed trees or slash for roosting, foraging, or as maternity sites. Therefore, firewood cutting on the MNF will not directly, indirectly, or cumulatively affect IB.

Gypsy Moth

The direct effects to IB of spraying pesticides for gypsy moth are extremely limited, as these pesticides have shown no impacts to vertebrate species (USDA 1995). Dimilin and B.t. pesticides may kill some moth and butterfly species, in addition to gypsy moth, although the effect is most likely less with Bt as it is less persistent in the environment. Indirectly, this would reduce IB prey, making it harder to meet energy needs. Since the pesticide Gypchek is specific to gypsy moth, impacts from its application would be quite limited. Adult bats probably would fly to untreated areas to forage and be minimally affected by gypsy moth pesticide use. Young IB that cannot fly as far, however, would likely be stressed by prey reduction.

Dimilin and B.t. application as well as tree defoliation by gypsy moth reduces Lepidoptera numbers, and therefore, IB habitat suitability. Dimilin has not been applied on the MNF since 1991. Since 1995, B.t. and Gypchek have only been used on the study areas described in the "Current and Projected Management" section of this BA. Egg mass numbers are higher than they have been in several years and spraying on private land and NF land is likely in the near future in certain areas. National Forest lands will be treated most likely with Bt. Efforts will be made to avoid spraying within 5 miles of a hibernacula. If spraying within the 5 mile radius is necessary, Gypchek will be the preferred method.

On private lands, however either Bt or Dimilin use is likely. These measures make the effects of gypsy moth spraying discountable.

Long-term gypsy moth defoliation can cause tree mortality, which creates more potential roost trees. More solar radiation can reach and warm those roost trees, providing more suitable maternity roost trees. Simultaneous habitat changes also likely will improve understory foraging for the same reasons described for prescribed fire.

Road Construction/Reconstruction

Since road construction involves felling trees, the direct effects described for regeneration harvesting apply to road construction. Because of the extremely small number of acres affected annually, the potential direct effect to IB from this activity due to tree harvesting is small.

The MNF has 1786 miles of Forest system roads that provide IB travel corridors and quality foraging areas. Only 30% of these roads are open to public vehicular travel year-round. However, most MNF roads are low standard/low speed roads, used mostly during the day. So while bats could be killed as they travel or forage along system roads, that potential is very small and probably much less than the potential to be killed along high-speed roadways.

Roads can increase predation of IB because predator travel may become more concentrated on roads compared to surrounding unroaded areas. Road-predation effects probably are not substantial because predation is not a limiting factor for IB (MacGregor, pers. comm. 1999).

During each of the last 5 years, approximately 47 acres of MNF land have been converted to roads. This affects a very small area of the MNF yearly. Road construction results in potential roost and maternity tree loss, but forest roads simultaneously create travel corridors and increased edge, which provide diversified foraging habitat. Consequently, road construction has potentially beneficial and detrimental effects for bats. Due to the low number of acres impacted, these effects are deemed discountable.

Recreation

Direct effects of recreational cave use on IB are the same as described for VBEB in this BA. Disturbance and stress to hibernating IB during hibernation can be detrimental or cause death. While the potential for IB disturbance on the MNF still exists, it has been reduced substantially by gate construction or reconstruction on most known IB hibernacula.

Roosting bats can be affected by hazard-tree removal at recreational facilities. Hazard trees are removed to ensure recreational-user safety; the numbers cut annually are small, but the direct effects described for any type of harvesting apply here. Because of the very small number of trees involved, this impact is discountable in both the general forest area and within the 5 mile zones. Use of developed-recreational facilities and trails would not affect IB because they are nocturnal and do not forage during the day. The limited amount of trail construction done each year removes very few overstory trees, as trails are designed to avoid removing large trees.

The small number of trees that are removed from developed recreation sites each year create only small habitat changes, and therefore, equate to no real change in IB habitat suitability. In addition, many developed recreation areas are well lighted and/or contain pavilions and outbuildings. Lighting increases insect abundance and foraging opportunities. Outbuildings located throughout the MNF may be used for roosting.

Wildlife Habitat Improvements

Most MNF wildlife habitat improvements consist of maintenance or creation of wildlife openings, savannas, and waterholes or ponds. These improvements usually require felling and removing trees, which would have the effects similar to those described for road construction. Most of these activities are done within the scope of timber sale projects and involve around 100 – 150 acres per year. Because of the limited scope of this activity the potential for a direct negative effect to IB from tree felling is extremely unlikely, and therefore discountable.

Although maintenance and creation of habitat improvements may remove potential roost trees, they can increase IB habitat suitability. Waterholes provide drinking water for bats and increase the production and availability of aquatic insects, which are eaten by bats. Lack of open water for drinking can be a limiting factor for IB in forests. Herbaceous vegetation, forest edges and less-dense forest canopies created by and around openings and savannahs provide additional quality-foraging areas. Herbaceous areas yield different insect assemblage throughout the year, compared to insect hatches in closed canopy forests. These differences supplement food supplies when forest insect production is low. Wildlife structures, such as waterfowl and squirrel nesting boxes, provide additional potential night roosts.

Fisheries Improvements

Direct effects of MNF fisheries management are limited to those associated with cutting a tree containing IB. These impacts are similar to those described for hazard tree removal under Recreation, as very few trees are cut annually for fisheries management. For example, on average 2 miles of streams have had fisheries improvement work per year, approximating 80 trees being cut for "tree drops" to help stabilize the bank and provide cover (Tom Cain, pers. comm.) This level of potential impact is discountable. Fisheries management may benefit IB indirectly since IB roost and forage on emerging aquatic insects in riparian habitats. Stream liming, large wood placement, and pool creation increase aquatic insect abundance and enhance IB foraging.

Range

Continued grazing of MNF range allotments will not directly affect IB, because this species does not appear to use the open field habitat for foraging.

Maintaining pastures may benefit IB indirectly because most of the MNF supports closed or nearly closed canopy forests. Range allotments provide large permanent openings and edges that produce different insect prey and habitat diversity.

Mineral Activity

Gas and mineral activities usually require timber harvesting to create well pads, linear pipelines, and roads. Direct and indirect effects to IB from natural gas and mineral activities are similar to those listed under roads/road construction. These long-term openings improve IB foraging in the same ways described for wildlife habitat improvements.

SUMMARY OF CUMULATIVE EFFECTS

Summer Roosting and Foraging Habitat

The cumulative effects in summer roosting and foraging habitat need to be evaluated in 2 different areas: the general forest area and the areas within 5 miles from the hibernacula. Individual tree felling in either area potentially could harm an individual IB, although the risk is small.

In the general forest area, direct effects cannot be discountable. Even though road construction/reconstruction, trail construction, wildlife habitat improvements, fisheries improvements, and mineral activities themselves are relatively minor in terms and potential effects to IB, adding these effects to those of the timber harvesting (a total of approximately 4600 acres annually) and prescribed fire, results in cumulative direct effects. As survey data for this species is not reliable for the length of most large-scale project implementation, this leaves the vulnerability that IB can move into an area where they were not detected previously and possibly be affected directly by that activity. These effects are magnified by activities on private lands, which may adversely affect habitat and force IB to move onto NF land. The major use of the general forest area by IB may be the bats migrating to and from the hibernacula.

In the 5-mile zone, the direct effects of all activities added up cumulatively are discountable because all major projects (such as regeneration and other harvesting) are done during hibernation period (April 1-Nov. 15). Smaller projects, such as trail work and hazard tree removal, that may occur outside of the hibernation period are so small in scale and in number as to be discountable.

Many of these activities will indirectly benefit IB by providing diverse roosting and foraging habitat. Some potential roost trees could be removed, but since bats use multiple roost trees and these activities can improve roost tree availability, adverse habitat effects would be minimal. Activities on private land can reduce available habitat in the 5-mile zone so any work in these areas will be carefully planned to ensure adequate desirable habitat remains.

TSI, wildlife habitat improvements, and prescribed burning produce beneficial effects for IB habitat, but few acres are affected annually and this impact is discountable.

Road building causes permanent but minor (in terms of total acreage) habitat loss. Road construction is decreasing on the MNF. On some private industry lands, it is common. A lot of the private land in and around the MNF is neither developed nor well roaded. Roads do provide some benefits to IB, including travel corridors, road-rut water sources, and edge for foraging. Most roads on the MNF are seeded or allowed to "grass-in" after use, enhancing their ability to provide quality foraging areas.

Use of non-specific pesticides, such as Dimilin and Bt are likely to be used in the future, by private landowners as well as on NF land, which could have some effect on prey base for the IB. However, relative to the effects of wider spread forest defoliation, and resulting indirect loss of prey base, that may occur if the gypsy moth goes unchecked, this effect is in all likelihood minimal and therefore the cumulative effect is considered discountable

Fall Swarming Habitat

Since swarming occurs within the 5 mile zones, effects to swarming habitat are already addressed above. The MNF currently does not allow commercial timber felling within swarming areas from April 1 through November 15 to ensure IB experiences no direct effects, as IB occur in these areas in greater numbers than they do in the general forest area. Activities within 5-mile radius of known IB hibernacula also are carefully designed to ensure quality-foraging habitat is maintained. Also, some land within 5 miles of these caves is privately owned, and activities on these lands also could be affecting swarming bats.

Hibernaculum

Even though the species' population continues to decline as a whole, wintering IB populations in West Virginia have increased since the MNF implemented its Forest Plan. This indicates that Forest activities are not negatively affecting hibernating bats or their hibernacula. The Forest Plan requires a 200-ft buffer around caves that contain hibernating bats. Although important hibernacula are gated and closed to protect endangered bats, it would be impossible to gate every potential or known hibernacula on the MNF. Some disturbance to IB in WV caves is still occurring. Where gating is not possible, other actions, such as signing as closed, are taken to minimize disturbance to wintering bats.

Recreational cave use is increasing, and private landowners may deny access to their caves for liability reasons. Increased use of MNF caves may result. Private cave commercialization inadvertently can disturb and eventually destroy bat populations (Mohr, 1972), while other cave owners actively attempt to eliminate bats. The current three privately owned commercial caves within the MNF's proclamation boundary likely will continue to operate, but no new commercial cave industries are planned within the MNF's proclamation boundaries. Outfitter guide proposals for MNF cave expeditions may result from increasing cave interest, but the MNF would not grant outfitter/guide permits for caves supporting endangered bats.

SUMMARY OF POTENTIAL EFFECTS TO THE INDIANA BAT

Potential Beneficial Effects:

1. Habitat enhancement by increasing diversity of roosting and foraging habitat.

2. Habitat enhancement by creating water sources and conditions favorable to prey populations.

3. Strong riparian area protection, which protects quality foraging habitat and potential roost trees located along riparian areas.

4. Protection of the 5 mile zone around hibernacula, and the 2 mile zone around maternity colonies, if found.

5. Cave entrances and 200 feet radii are protected as special areas.

Potential Adverse Effects:

1. Removing trees when IB are not in hibernation could result in harm or death to individual bats.

2. Potential roost tree loss through tree removal.

3. Foraging habitat deterioration through mature tree removal that results in < 50% canopy cover.

4. Habitat (roosting) loss through road surfacing or creation of large openings.

5. Potential direct effects from prescribed burning activities.

DETERMINATION

A MAY AFFECT, LIKELY TO ADVERSELY AFFECT determination is made for prescribed fire and for all activities that involve tree cutting (regeneration harvest, thinning and single tree selection, timber stand improvement, road construction/reconstruction, recreation, wildlife habitat improvement, fisheries improvement, and mineral activity) that occur outside of the 5 mile zones. Across the Forest activities, including minerals, that require tree cutting will not exceed 6000 acres per year. Prescribed burning will not exceed 300 acres per year. A MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for all activities described above but within the 5 mile zones and for gypsy moth and range. A NO EFFECT determination is made for firewood cutting.

The direct effects (i.e. chances of harming an IB) of MNF tree cutting or prescribed burning activities in the general forest area, although relatively minimal, is not discountable due to several factors: possible evidence of nearby maternity activities, the ability of this mobile species to move into "cleared" project areas, and the lack of sufficient knowledge of this species. This is true for all habitats and seasons that IB may be using the MNF except for hibernation. During summer, extensive (and continuing) survey data indicate IB numbers across the MNF are extremely small relative to available acres or project acres. Within the 5-mile zones, effects are discountable because little project work is done outside of the hibernation period, as presence of IB is assumed.

Overall, indirect effects to IB habitat in both the general forest area and the 5-mile zones from MNF activities are often positive and not likely to adversely affect IB. Most MNF acreage provides potential roosting habitat and many MNF activities improve roosting habitat. In commercial timber harvests and other activities in which trees are felled, potential roost trees are removed; however, the effects are extremely minor compared to total roost tree numbers.

MEASURES TO MINIMIZE POTENTIAL ADVERSE EFFECTS TO THE INDIANA BAT

1. Implement measures identified in the Biological Opinion.
2. Continue retaining shagbark hickories in cutting units.
3. Monitor snag retention in cutting units. If an average of less than 6 snags/acre, manually create additional snags.
4. Continue to seek maternity sites and evidence of summer use on the MNF using survey methods and frequencies that follow guidelines and protocol established by USFWS, in consultation with USFWS.
5. Continue to protect swarming areas (5-mile radii around hibernacula) by not allowing large-scale tree felling activities from April 1 through November 15.
6. Continue to look for maternity colonies (through mist netting the area and using radio telemetry if possible) in the area of the juvenile male capture of August 1999.
7. Impose buffers around maternity colonies, if found. Appropriate buffers will be determined through consultation with USFWS.
8. Exceptions to any of these measures would be made only through consultation with USFWS.

VIRGINIA BIG-EARED BAT

The Virginia big-eared bat (VBEB), *Corynorhinus townsendii virginianus*, reclassified from the genus *Plecotus*, was listed as endangered under provisions of the Endangered Species Act on December 31, 1979. A Recovery Plan, developed by the U.S. Fish and Wildlife Service, was signed May 8, 1984.

DISTRIBUTION

VBEB is a geographically isolated and sporadically distributed cave obligate species. While it is known from karst areas in eastern Kentucky, eastern West Virginia, extreme western Virginia, and western North Carolina (Clark and Lee 1987), West Virginia holds its largest populations, particularly Pendleton County (Barbour and Davis 1969, Stihler pers. comm. 2000). West Virginia's Cave Mountain Cave, Hellhole, Hoffman School Cave, Sinnit Cave, and Cave Hollow/Arbogast Cave are designated as "Critical Habitat" for this species based on the precise physical structure, temperature, and humidity conditions required for its continued survival, as well as the significant number of VBEB that occur there. Cave Mountain and Cave Hollow/Arbogast are on the MNF.

REPRODUCTION

Females mate in their first autumn, and are inseminated during late August. While most breeding occurs in the winter roosts, some females are inseminated before roosting. Males usually do not breed until their second year.

Female bats store sperm over winter and fertilization occurs in spring. Pregnant females can appear in maternity caves as early as mid-March. In West Virginia most young are born in June, after a 56-100 day gestation period. Females have only a single offspring annually, which is born and remains naked for its first few days. If disturbed, female VBEB can carry their young to other parts of the cave or to other caves. Young bats grow rapidly; at three weeks old, while still dependent upon their mothers, they are capable of flight. At one month they develop adult-length forearms. By six weeks, juveniles leave the roost at night with adults. Young are weaned at about two months (Barbour and Davis 1969).

FOOD HABITS

VBEB feed predominantly on moths (Dalton et al. 1986, Sample and Whitmore 1993). Lepidoptera (moths) were the most abundant order in VBEB guano, both by volume and percentage occurrence. Coleoptera (beetles), Diptera (true flies and mosquitoes), and Hymenoptera (bees, wasps and ants) numbers were moderately frequent, but accounted for little volume (Sample and Whitmore 1993). Moths may be more readily available than other insects due to their abundance, active periods, and/or ease of capture, or Virginia big-eared bat may be adapted to hunt moths.

GENERAL HABITAT CHARACTERISTICS

Summer Maternity Habitat

Maternity colonies generally utilize warm caves, though some may use cold caves. In the latter case, colony body heat trapped in the ceiling domes provides sufficient warmth for maternity use. Bats that inhabit caves and mines during summer days form tight clusters, presumably because the resulting elevated cluster temperatures aid in food assimilation (Handley 1959 in Barbour and Davis 1969). Gestation, lactation, and other reproductive processes may also be facilitated by high clustering temperatures (Pearson et al. 1952).

Nocturnal activities in maternity colonies vary as the maternity season progresses. During May and most of June, when females are pregnant, the colony remains outside the cave most of the night. After birth in late June and July, nightly emergent behavior of the mother depends on the needs of her young.

When the young are weaned in August, nursery colonies disperse. Females that have lost their young leave earlier than lactating females, and young males tend to leave earlier than young females (Barbour and Davis 1969).

Male VBEB also use caves in the summer, although they inhabit different areas of the cave than the females, and roost together in bachelor colonies. The males don't appear to have strong site fidelity, and don't have exacting demands for caves like females (Wallace pers. comm. 1999).

Summer Foraging Habitat

Observational research shows VBEB forage only after dark. Conditions outside the cave must be suitably dark before they will leave to forage (Barbour and Davis 1969).

Geographically isolated VBEB populations have different foraging habitats (Dalton et al. 1989, Adam et al. 1994, Buford and Lacki 1995). In Virginia, VBEB forage over open pastures, corn and alfalfa fields, and around tree crowns (Dalton et al. 1989). In contrast, VBEB populations on the Daniel Boone National Forest, Kentucky disproportionately use cliffs and forest habitat to forage, and rock shelters at cliff bases are used as night roosts. Use of different foraging habitats among VBEB populations or subspecies is a response to different habitat availabilities and demonstrates its flexibility to local conditions (Adam et al. 1994).

VBEB forage near their maternity caves. In general, distances from roosts to centers of foraging areas do not differ between males and females (Adam et al. 1994), though foraging area size for females may increase during the summer. Adam et al. (1994) found female foraging areas are smallest in May, when maternity colonies have just formed and females are pregnant. Kunz (1974) hypothesized that forage areas decrease during lactation because of recurrent visitations to maternity roosts. However, Adam et al. (1994) observed no changes in foraging distances during May compared to other months. The maximum distance a male bat has been found from its roost was 5.04 miles (8.4 km). Maximum distance a female was found from the maternity colony was 2.19 miles (3.65 km) (Adam et al 1994).

Fall/Migratory Habitat

VBEB move readily from one roost to another, but they probably do not migrate long distances (Barbour and Davis 1969). Furthest movement out of 1,500 banded big-eared bats in California (Pearson et al. 1952) was 20 miles by a young male. Barbour and Davis (1969) recorded movement of 38.6 miles (64.4 km) in Kentucky, and Harvey et al. (1981) reported a 3.9-mile (6.5 km) movement between hibernacula and maternity cave in Arkansas.

Hibernacula

VBEB begin to return to hibernacula in September, but continue feeding during warm evenings. By December, they hibernate in dense clusters on cave ceilings.

Throughout their range, VBEB hibernate in caves and mines, which provide cold (3-7 °C), but above freezing temperatures. In Kentucky and West Virginia, VBEB sometimes hibernate in clusters of several hundred to more than a thousand, occupying the same spot within the cave year after year. Ages and sexes of bats hibernating in small clusters appear to be random, but large clusters usually are comprised of nearly equal numbers of both sexes. Winter clusters stabilize body temperatures against external changes. Handley (1959) stated that winter clusters protect the bats from heat rather than cold, but they likely minimize changes in both directions (Barbour and Davis 1969).

HABITAT ON THE MONONGAHELA NATIONAL FOREST

Fourteen West Virginia caves are known to be VBEB hibernacula, summer maternity sites, or both. Three of those caves are located on the MNF; they harbor approximately 30% and 7% of all VBEB in West Virginia during summer and winter, respectively.

Thirteen of the 14 VBEB caves in West Virginia are gated, fenced, or signed as closed; agreements with private landowners exist for several caves to deter people from disturbing bats during critical periods.

Based on information that VBEB travel up to 6 miles from their caves to forage (Stihler 1995), the area within this 6-mile radius would be the habitat used by this species. The habitat surrounding the VBEB caves on the MNF is very diverse. Seventy-six percent of these 559,486 acres is privately owned, and the majority is in agricultural use. Other known land uses in this area are timber harvesting, strip mining, limestone/rock quarries, two commercial caves, as well as Canaan Valley State Park, Blackwater Falls State Park, Canaan Valley Wildlife Refuge. A growing trend in this area is second home development.

The National Forest land around VBEB caves is all forested with the exception of a very small percentage of wildlife openings and several range allotments. The majority of the forested acres are over 60 years old. Three percent of this area is in wilderness and will not have any vegetation management done on it. Another 15% is in MP 6.2, and will experience only limited vegetation management, if any.

Summer Roosts/Hibernation

Eleven caves in WV are monitored for summer VBEB use by WVDNR. Three of these are on MNF land. Cave Hollow/Arbogast Cave has had the largest maternity colony sites of these caves, and is also a hibernaculum. As a designated Critical Habitat by the USFWS, it is closed year round to public entry. Cave gates were installed on 4 known Forest Service entrances and 1 private entrance to this cave system in 1996. Prior to 1996, 10-ft chain-link fences were used as closure devices but they did not effectively exclude vandals. The new gates appear to have increased the suitability of this cave. In 1999 summer maternity censuses counted 620 VBEB compared to 559 in 1995. Winter counts increased from 287 in 1995 to 296 bats in 1999.

Cave Mountain, also designated as Critical Habitat, is used as a maternity colony site. It is closed to the public from April 1 through September 1, and opened in winter. Rebar style gate closures were replaced in 1995 with angle-iron gates. Summer 1998 censuses counted 637 bats exiting the cave to forage. This is a 10% decline from 1997 surveys, however, a nearby cave on private land has increased by approximately this same number so it appears that the bats have switched roost sites.

Peacock Cave is a VBEB hibernaculum and maternity cave. It is isolated and signed for year-round closure. The entrance is extremely small and currently not gated. Gating would be a last resort since gate installation could affect airflow and microclimate at such a small entrance. WVDNR data have indicated no population problems from human disturbance in this cave. In fact, maternity colony populations have increased since 1983. Summer colony census counted 862 bats in 1998, up from 800 in 1997.

Known summer VBEB colonies within the proclamation boundary of the MNF were estimated at 6,275 in June 1998 using night vision equipment. Summer counts are completed by placing infrared lights around cave entrances and using night vision scopes to count bats as they exit. Tables 2 and 3 provide VBEB summer and winter populations counted by the WVDNR.

Table 2. Results of WVDNR VBEB Summer Census in West Virginia

YEAR	C.Hollow/Arbogast	Cave Mountain	Cliff	Hoffman School	Lambert	Mill Run	Minor Rexrode	Mystic	Peacock	Schoolhouse	Sinnitt/Thorne	TOTAL
Ownership	Forest Service	Forest Service	Private	Private	Private	Private Pendleton Co.	Private	Private	Forest Service	Private	Private	
	Critical	Critical	Outside Proc. Bound	Outside Proc. Bound	Within Proc. Bound.	Within Proc. Bound.	Outside Proc. Bound.	Within Proc. Bound.		Within Proc. Boundary	Outside Proc. Boundary	
Closure	gated	gated	signed	gated	gated	signed	gated	signed	Signed	gated	gated	
1983	650	808	-	755			95	254	160	338	153	3213
1984	800	728	-	755	209		171	250	183	378	216	2890
1985	739	812	-	771	230		147	209	207	368	238	3721
1986	1080	703	-	739	277		161	239	239	547	338	4323
1987	1015	861	-	780	96		206	267	254	548	426	4453
1988	1137	773	-	930	58		151	283	326	515	454	4627
1989	286	931	-	753	49		132	274	396	537	560	3918
1990	325	881	-	711	65		133	287	466	449	538	3855
1991	420	826	-	777	116		287	253	497	719	560	4455
1992	423	805	1350	906	112		194	338	573	612	466	5779
1993	454	762	1292	942	134	114	356	357	635	629	168	5843
1994	491	796	1350	857	132	153	504	319	652	673	304	6231
1995	559	742	1350	849	122	204	398	367	730	649	418	6388
1996	513	768	1243	980	126	167	377	377	772	701	344	6368
1997	454	736	1004	970	123	231	412	397	800	815	279	6221
1998	538	637	1179	828	131	293	482	406	862	732	187	6275
1999	620	568	1250	850	106	335	534	488	827	655	183	6416
2000	618	471*	1250**	890	29	312	434	538	858	718	245	6310

*Bats had started to give birth. Not all bats left the cave.
** Cave not counted in 2000 – number assumed to be the same as 1999.

Table 3. Results of WVDNR VBEB winter census in WV (Stihler, 1988-1999)

YEAR	C.Hollow Arbogast	Cave Mountain	Cliff Cave	Minor Rexrode	Peacock	Schoolhouse	Sinnit Thorne	Hellhole	Harper Trail
1988	163	7							4
1989				225	26	343	47	4664	
1990		2							1
1991	319	1[1]		293	49	473	21	6188	
1992		2							1
1993	397		69	197	22	575	2	4965	
1994		15							1
1995	287	0	284	184	20	393	3	6378	
1996									0
1997	348[2]	28	143	256	108	1323	17	3862	
1998									0
1999	296[3]		186	187	16	642	3	9597	
2000		1							

[1]Surveyed upper and lower section to little brown room
[2]Surveyed only front portion of this cave this season
[3]Did not survey passage parallel to Cave Hollow passage.

Summer Foraging

For the eleven caves that have VBEB summer roosting, the habitat available within a 6 mile foraging distance is very diverse. The majority of this is not National Forest system lands and mostly is in agricultural fields. Of the <25% that is National Forest, >95% is in forested habitat.

In May 1991, WVDNR radio tracked several female VBEB. One female traveled 3-4.2 miles (5-7 km) from the cave to feed, and individual bats usually foraged in the same general areas on successive nights. Recent clearcuts and grazed land were not used. The one radio-tagged bat traveled directly from the cave to unmowed hayfields where it foraged for about 2 hours, after which it night roosted for another 1-2 hours. Following night roosting, the bat spent most of its time in wooded areas, especially a small wooded ravine west of the hayfields. The study was continued in late July 1992, and while foraging occurred in both wooded and open habitats, wooded habitats were used more than in 1991. During both studies, bats rarely returned to the cave during the night, even in July when females had young remaining in the cave. (Stihler 1994)

No specific stand information was collected in these studies, and approximately half the bats foraged on private lands for which the Forest Service has no stand data. However, those bats foraging on National Forest land used mixed oak or oak/Virginia pine stands, as determined from Forest Service compartment and stand data references.

The WVDNR study continued in late June-early July 1994 found lactating female bats foraged in wooded areas and open habitats. Grazed areas used by the bats consisted of old fields with considerable vegetative structure composed largely of thistles, scattered trees, and riparian vegetation along a small creek. During the night, bats returned to the nursery colony up to 3 times, presumably for young to nurse. However, these bats foraged further from the cave than during previous radio tracking sessions. The greatest distance traveled was approximately 6 miles (10.5 km) from the cave. Even when return trips to the cave were necessary, bats did not select foraging areas close to the cave. Individual bats often had foraging areas that they used on consecutive nights, but most bats appeared to have more than one foraging area (Stihler 1995).

Fall/Migratory Habitat

Late summer telemetry studies (9August -21August) indicate that VBEB on the MNF are using similar habitats for foraging as documented for early summer with the exception that agricultural fields (corn and possibly soy beans) were used during this session and not earlier (Stihler, 1999). Fall foraging data on the MNF is limited.

VBEB appear to move readily from summer roost caves to other caves for winter hibernacula. VBEB banded during recent summers were located at several different caves during winter surveys. VBEB banded at Elkhorn Cave were found at Cliff Cave (approx. 114 miles). VBEB were also observed in Hellhole up to 32 km. from were they were originally banded at Cave Mountain Cave, Elkhorn Cave, Minor Rexrode Cave, and Sinnitt Cave. (Stihler, 1999, Stihler, et al. 1997)

CAUSES OF PAST AND CURRENT DECLINES

Cave-dwelling bats are particularly at risk due to human disturbances. During hibernation, bats subsist on stored body fat. When disturbed during winter, they emerge from hibernation and move to a safer roosting area in the cave. This activity requires a bat to raise its body temperature by burning stored fat. As few as two disturbances can cause a cave-dwelling bat to expend all its fat reserves and then starve since no flying insects are present to feed upon (Nieland date unknown).

Rearing success is also at risk during spring and summer when females cluster in warm portions of caves to rear young. If maternity colonies are disturbed, females may abandon their flightless newborns, move their pups to locations less suitable for newborn survival (Nieland date unknown), or drop their pups in transit if sufficiently panicked.

Vandalism has resulted in destruction of many bat colonies simply because bats often are viewed as nuisances or threats to human health (USFWS 1996). Other possible causes of bat population declines include: natural disasters (flooding, cave subsidence), alteration of summer maternity habitat and winter hibernacula, and chemical contamination. Cave commercialization may disturb summer and hibernating bat colonies, and stream impoundment can create permanent or seasonal cave flooding (USFWS 1983). Timber harvesting, water quality degradation, stream channelization, and other actions potentially could alter foraging habitat in some cases (Grindal 1996).

Historic collecting, handling, and banding by biologists during hibernation and early rearing also probably have contributed to VBEB population declines (USFWS 1984). To minimize current disturbance problems, winter hibernacula counts are conducted biennially instead of annually. Bands placed on bats collected by mist netting during the maternity season are believed to have discountable effects on bats.

Poorly designed and installed cave gates restrict bat movement and alter airflow into caves. Airflow alterations may change the microclimate, rendering the cave unsuitable for hibernation. Microclimate changes caused by increased or decreased airflow are probably major contributors to hibernacula degradation. Even small entry point blockages can be extremely important in hibernacula that require chimney-effect airflow to function. Airflow changes can elevate temperatures (Richter et al. 1993) in the caves and cause the bats' metabolic rate to increase, resulting in premature exhaustion of fat reserves (USFWS 1999).

Insecticides, particularly those used for gypsy moth, may adversely affect the food supply (Sample and Whitmore 1993). Several animals, including house cats, owls, hawks, raccoons, skunks, and snakes are known to prey on bats.

SUMMARY OF VBEB SURVEYS CONDUCTED IN WEST VIRGINIA

WVDNR monitors summer maternity populations throughout the state annually. Observers with night vision scopes count bats as they exit maternity colony sites to minimize effects to young bats. Winter populations are counted biennially to minimize disturbance to hibernating bats. Monitoring results since 1988 are shown in Table 3.
During 1997-99**,** personnel from federal, state and private agencies, and volunteers and contractors surveyed several MNF project areas. Mist nets were placed in areas with high potential for bat capture, such as over wildlife ponds and road-rut ponds where bats come to drink or feed on emerging aquatic insects. Nets also were placed across woods roads within heavily forested areas. Forty-three VBEB were trapped at 15 net site locations. All captures were within 6 miles (10 km) of known hibernacula/maternity sites.

FOREST PLAN STANDARDS AND GUIDELINES PERTINENT TO THE VIRGINIA BIG-EARED BAT

General Forest-wide *Page*

The MNF Forest currently provides direction that protects VBEB and their habitat through several standards and guidelines.

Most caves on the Forest will be available for public recreation use, subject to control measure necessary to protect cave formations and endangered species. Some caves will be closed to public use to protect endangered species. Public entry into caves may be prohibited or restricted if providing significant habitat for T&E or unique wildlife species sensitive to disturbance by humans.....67

Caves and cave environments will be protected from damage resulting from surface activities 67

Forest-wide direction specific to VBEB

Identified nursery colonies, hibernation sites, and corridors will be managed under Zoological Area standards. Forage habitat will be managed under Forest-wide riparian area standards.

Endangered bat foraging habitat includes riparian land and vegetation approximately 100 feet wide along both sides of streams that are aquatic ecosystems, floodplains, riparian ecosystems, and wetlands. The following guidelines will apply:

-Vegetation manipulation, in the form of patch clearcutting, may be accomplished to perpetuate or establish desirable tree species or composition in the riparian areas.....88
-Major occupancy developments in riparian areas will not be encouraged but considered on a case-by-case basis through EA process.....88
-Extensive use of pesticides in foraging habitat should be avoided 88

The Forest Plan also provides direction for special areas, called Zoological Areas, that function as endangered species habitat. Important VBEB habitats have specific standards and guidelines listed below; these are in addition to Forest-wide and MP directions:

-Project activities in these areas require consultation with USFWS.

-Cave entrances will be signed and posted against entry. Locations not published for distribution to the public, no directional signs on roads or trails will be posted directing people to these caves.

-Special areas for protection of endangered bats are defined as 200 feet in radius from the entrances to inhabited caves.

-Avoid pesticide use in these management areas.

-No new facilities will be constructed for recreational use.

-Vegetative treatments may be undertaken if coordinated with bat habitat requirements in the Opportunity Area.

-In travel corridors, the objective is to maintain or create an unbroken forest canopy.

-Public entrance into caves used as hibernacula for VBEB will be prohibited from September 1 to April 15th.

-Public entrance into caves occupied on the National Forest will be prohibited during the nursery season from April 1 to September 15th.

-Entry into caves during the closed periods for scientific study and observation will be permitted by written approval of the Forest Supervisor and permit from the USFWS or equivalent.

-Gates installed at cave entrances will allow free entry and exit by bats and not restrict airflow.

-Gates will be maintained on a schedule based on past history of problems.

-Controlling forest fires will be a high priority to prevent bat asphyxiation or significant changes in vegetative cover.

-Prohibit special uses in the travel corridor that would be adverse to bat use.

-Surface occupancy will not be permitted for mineral operations on US minerals. When minerals are privately owned, consultation with the USFWS will be undertaken to minimize adverse effects on habitat.

-Acquiring any cave used by endangered bats inside the proclamation boundary will be high priority.

-Restrictions are placed on dynamiting during maternity or hibernation periods that could create a severe stress on bats.

-Transportation or utility routes should avoid the area.

-Prohibit placement of new utilities or roads across areas without assessment.

EFFECTS OF CONTINUED IMPLEMENTION OF THE FOREST PLAN

Regeneration Harvest

Regeneration harvest methods would not directly or indirectly affect hibernating VBEB, because the Forest Plan prohibits harvesting within 200 feet of cave entrances. Effects during non-hibernation periods are described below.

VBEB use caves year-round, although standing timber may be used for night roosts during foraging. Since the bats return to the caves before daylight, or occasionally day-roost under bridges or in manmade structures (Stihler pers. comm. 1999), there would be no direct effect on this species from timber harvesting activities.

The effects of various silvicultural practices on moths, the primary food source of VBEB, are largely unknown (Sutton and Collins 1991). Moth species use different habitats as a result of their different sizes and vegetative requirements. Thus, changes in moth populations caused by habitat changes, ultimately could affect bat populations (Hurst and Lacki 1997).

In the last ten years, 697 acres of National Forest land have been regenerated within VBEB habitat, which averages out to approximately 70 acres a year that have been changed from mature forest to early successional habitat. Given the extremely limited amount of the MNF land within VBEB habitat that is cut through regeneration harvest annually, the total impact of the potential indirect effect is very minor.

Thinning and Single Tree Selection

Thinning and single tree selection would result in the same direct effects as a Regeneration Harvest.

Indirect effects of thinning and single tree selection would be minimal. Unlike regeneration harvests, thinning does not open the canopy enough to change habitat types for VBEB or its prey. Greater habitat diversity would result in the short term, which might increase foraging slightly. In the past 20 years, only 5470 acres of VBEB habitat has been treated in this method, averaging out to approximately 270 acres a year.

Timber Stand Improvement

In the past 20 years, timber stand improvements have been done to 1067 acres. This treatment would have direct and indirect effects to VBEB similar to those described in the thinning and single tree selection section.

Prescribed Fire

Prescribed burns on the MNF are confined primarily to small acreages of open or brushy areas (range allotments or wildlife openings) in early spring or fall. Prescribed burning is likely to increase especially in oak-hickory forest types that are fire dependent. Burns would not be conducted within 6 miles of known hibernacula or maternity sites unless project specific analysis indicates smoke will not impact caves; consequently, the probability of smoke entering a cave during bat hibernation is very low.

Using fire to keep old fields from growing up in woody vegetation would benefit VBEB.

Firewood Cutting

Firewood permits are issued for dead and downed trees or tree tops/slash from closed timber harvest areas and along roads. VBEB do not utilize dead and downed trees or slash for roosting. Therefore, firewood cutting on the MNF will not directly or indirectly affect VBEB.

Gypsy Moth

Gypsy moth spraying occurs during the day when VBEB are in caves or under cover in temporary daytime roosts; therefore probability that a bat would be sprayed is very low. Consequently, gypsy moth control spraying will have no direct effects on VBEB. None of the 10-year study plots are located within 6 miles of VBEB hibernacula or maternity sites therefore spraying connected with this study has no effects on VBEB.

Indirect effects may result as Dimilin and B.t. kill and reduce species richness of moths, which are the major food source for VBEB. Gypsy moth defoliation may also reduce moth species richness. Gypsy moth spraying will be avoided within VBEB habitat as directed in the FP. However, in the case where infestations may result in greater risk of habitat degradation spraying may be necessary. If spraying is necessary Gypchek will be the preferred method. Spraying beyond 6 miles from maternity caves will have very little effect. Gypchek does not reduce species richness in the order Lepidoptera (to which most moths belong) and, therefore, will not indirectly affect VBEB.

Road Construction/Reconstruction

Road construction requires timber removal and, thus, would have the same direct effects as a Regeneration Harvest. Typically VBEB roost in caves, although they may use standing timber as temporary night roosts. Because road construction occurs during daylight hours, VBEB should not be affected directly by it.

MNF system roads provide travel corridors and foraging areas for bats. Only 30% of these roads Forest-wide are open to vehicular traffic year-round, and most MNF roads are low standard/low speed roads, used mostly during the day. So while bats could be killed as they travel or forage along Forest system roads, that potential is extremely remote, particularly given that there are only a few miles of system roads within all the forage areas. Most of the roads within VBEB habitat are State roads, which are open year-round and allow higher speed travel.

Due to the limited amount of timber harvesting that is being done in this habitat, the road building activities have not been extensive. During each of the last 5 years, approximately 47 acres of MNF land Forest-wide have been converted to roads**.** Simultaneously, forest roads create travel corridors and increased edge that provide diversified foraging habitat. Water in road ruts also provides drinking water for bats.

Recreation

As bats enter hibernation with limited fat reserves, a single disturbance may cause a bat to expend as much as 68 day's of its fat reserve (Thomas et al., 1990: USFWS 1997). Spelunkers and researchers passing near, collecting, handling, and banding hibernating bats cause arousal (Humphry, 1978; Thomas, 1995; USFWS 1997). If this happens two times or more during hibernation, the bat's fat reserves will be exhausted before it emerges in spring. Starvation and death can result. Blatant persecution of hibernating bats is a threat in non-gated hibernacula, or where cave barriers have been breached. Other subtler microclimate changes, created by human body temperature, carbide cave lights, or airflow changes (usually from cave gate installations), or more dramatic changes from natural occurrences (flooding or cave-ins) can affect VBEB. However, the potential for VBEB disturbance during hibernation on the MNF has been reduced substantially by gate construction or reconstruction on most known VBEB hibernacula.

Other recreational activities, such as hiking, would have little effect on VBEB because these activities occur during the day when bats are in caves or roosts.

The MNF maintains six recreation areas within VBEB habitat, ranging from day use picnic areas to the Seneca Rocks Discovery Center. Most developed recreation areas have pavilions and outbuildings, which may be used as night roosts for VBEB. Human disturbance around these facilities at night may cause roosting bats to leave for another roost, although most use occurs during daylight hours.

Wildlife Habitat Improvements

Most MNF wildlife habitat improvements consist of maintenance or creation of wildlife openings, savannahs, and waterholes or ponds. Tree removal is required for their creation, so the direct effects are the same as for a Regeneration Harvest or Thinning and Single Tree Selection. As with other management activities, wildlife habitat improvement projects proposed beyond 6 miles from known VBEB hibernacula would not affect VBEB. Wildlife habitat projects within 6 miles of known hibernacula would not affect VBEB as any tree felling or heavy equipment activity would occur during the day when the bats are in the caves.

Maintenance and creation of wildlife habitat improvements would benefit VBEB. The Showalter tract, which is a maintained 40 acre wildlife opening within 6 miles of Cave Hollow/Arbogast is providing open field habitat for VBEB to forage in. Waterholes provide drinking water for bats and increase the production and availability of aquatic insects, which are eaten by bats. Lack of open water for drinking can be a limiting factor for VBEB in forests. Herbaceous vegetation and less dense forest canopies created by and around openings and savannahs provide additional quality-foraging areas. Wildlife structures, such as waterfowl and squirrel nesting boxes, provide additional potential night roosts.

Fisheries Improvements
Fisheries improvements, such as stream liming, large wood placement, and pool creation do not affect VBEB because these activities are so small in scope.

Range
Continued grazing on MNF range allotments will benefit the VBEB since it forages over openings and the grazing activity keeps the fields open. There are 17 range allotments that occur all or in part within VBEB habitat.

Mineral Activity
The MNF permits mineral exploration and extraction, primarily natural gas. Forest plan standards and guidelines address mineral exploration to avoid directly affecting VBEB.

Direct, indirect, and cumulative effects to VBEB from natural gas and minerals activities are the same as for a Regeneration Harvest. However, forest habitat changes associated with minerals extraction, such as pipeline and well pad construction, will be long-term or permanent.

SUMMARY OF CUMULATIVE EFFECTS

The direct effects of all Forest activities combined do not become significant for VBEB when added up cumulatively. This species does not use trees for day time roosting, so there is no vulnerability of harm from harvesting or other disturbances.

The majority of the habitat for the VBEB (the areas within 6 miles of a hibernacula or maternity cave), is private lands, and is in mixed habitats consisting of forests, pastures, and other agricultural uses. This is providing a variety of foraging opportunities for this species. Most activities analyzed would have a somewhat beneficial effect on this species by adding to that diversity of habitat (i.e. travel corridors). Maintaining the habitat diversity of this area would have a positive effect. Any activity done to convert the whole foraging area to one habitat type would have adverse cumulative effects.

Forest Service activities such as prescribed burning, TSI, and wildlife habitat improvement produce positive effects for VBEB, (by diversifying habitat) but are done in such small amounts within their foraging range, there would be no measurable effect.

Other activities, such as road construction and timber harvesting could reduce habitat suitability if done too extensively in foraging areas, but the Forest is aware of the sensitivity of these areas and it is unlikely that much would be proposed in VBEB habitat.

Cumulative effects from recreation could stem from the increased popularity of caving. As the number of spelunkers increases, private landowners may limit or restrict entry into caves on their land due to associated liability. This restriction may shift and increase use to MNF caves. Although important hibernacula are gated and closed to protect endangered bats, gating every potential hibernaculum in the state would be logistically and legally impossible. Thus, unrestricted spelunking across West Virginia could have negative effects on VBEB sometime in the future.

Cave commercialization can disturb and destroy bat populations (Mohr 1972). Currently there are 3 privately owned commercial caves within the proclamation boundary of the MNF. These "caverns" likely will continue as commercial ventures. Presently, no new commercial cave industries are planned within MNF proclamation boundaries, but the increasing caving interest soon may spur outfitter guide proposals for MNF cave expeditions. The MNF, however, would not grant outfitter/guide permits for caves supporting endangered bats.

Currently there are 3 quarries operating within VBEB habitat. If the quarry nearest Hellhole shifts its operation in the direction of that cave, it could affect that VBEB population adversely. The MNF expects no new surface mineral exploration in the foreseeable future. The three MNF VBEB caves will continue to be closed during critical times. Bat populations will be monitored at least every other year by the WVDNR.

As this species often uses old buildings as night roost sites, tearing down any existing old buildings, which is a common practice on NF land, within the 6-mile radius from VBEB caves could reduce possible night roost areas, but it is not known whether this is a limiting factor.

SUMMARY OF POTENTIAL EFFECTS TO VBEB

Potential beneficial effects:

1. Provide a diversity of habitats within the 6 mile foraging radius.

2. Protect summer and winter caves.

3. Cave entrances and 200 feet radii are protected as special areas.

Potential adverse effects:

1. Removal of old buildings within 6 mile foraging radius.

2. Commercial use of caves with VBEB.

DETERMINATION

A MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for regeneration harvests, thinning and single tree selection harvests, TSI, prescribed burning, gypsy moth, road construction/reconstruction, gypsy moth, recreation, wildlife habitat improvements, range, and mineral activity on the VBEB, as the measurable impacts of these activities are more likely to be beneficial than harmful to this species. There would be NO EFFECT from firewood cutting, and fisheries improvement.

MEASURES TO MINIMIZE POTENTIAL ADVERSE EFFECTS TO VBEB

1. Work with WVDNR to evaluate old buildings on MNF land within the 6-mile foraging radius to see if VBEB are using them.

2. No special use permits will be issued for commercial cave ventures in caves that harbor VBEB.

WEST VIRGINIA NORTHERN FLYING SQUIRREL

On July 31, 1985, USFWS listed West Virginia Northern Flying Squirrel (WVNFS) *Glaucomys sabrinus fuscus* as endangered (50 CFR Part 17). An Appalachian Northern Flying Squirrels (*Glaucomys sabrinus fuscus) (Glaucomys sabrinus coloratus)* Recovery Plan (USFWS 1990) was released September 24, 1990, for two endangered subspecies of northern flying squirrel.

DISTRIBUTION

Twenty-five subspecies of northern flying squirrel occur in boreal coniferous and mixed northern hardwood/coniferous forests of North America (USFWS 1990). They cover an extensive range from the Pacific to Atlantic Coasts. Northernmost records come from the cold boreal spruce forest of central Alaska and the mouth of the MacKenzie River in the Northwest Territory of Canada across Canada to Labrador. In the West, northern flying squirrels range from Alaska southward along the costal mountain range to northern California, and in the Sierra Nevada their range extends southward into California. The Rocky Mountains harbor populations down to southern Utah and eastward through Wyoming to the Black Hills of South Dakota. (Wells-Gosling 1985)

In the eastern United States, the southern border of their range is in the northern tier states, although isolated populations are irregularly distributed at high elevations in the Appalachian Mountains as far south as Tennessee and North Carolina (Ibid). The disjunct distribution of subspecies in the Southern Appalachians (Fig. 6) and their great distance from the center of the species range in the northern United States and Canada suggest that they are relicts that have become isolated in small patches of suitable habitat by changing climatic and vegetational conditions since the last ice age (USFWS 1990).

At the time of its listing, Stihler et al. (1995) noted that only ten WVNFS specimens in Randolph and Pocahontas Counties in WV and two specimens from Highland County in Virginia were known. Subsequent nest box surveys and live trapping done from 1985 through July, 1999 in West Virginia found 878 additional WVNFS at 91 sites in Greenbrier, Pendleton, Pocahontas, Randolph, Tucker, and Webster counties (Stihler and Wallace 1999). As of 2001, over 1,000 WVNFS have been captured. WVNFS have been captured above 2,750ft in elevation (WVDNR unpub. data), which closely parallels red spruce distribution in West Virginia's Allegheny Mountains. The WVNFS range extends southwestward from Canaan Heights and the northwestern edge of Dolly Sods Wilderness (both in Tucker County) to Briery Knob (Pocahontas County) and Rabbit Run (Greenbrier County) (Stihler et al. 1995). A recent capture in 1999 extends the range of the species north from Canaan Heights to North Fork of the Blackwater (Tucker County) (WVDNR, unpub. data). The MNF contains more than 90% of West Virginia's WVNFS habitat (Stihler, pers. comm. 1999), including 89 of 91 capture sites (Wallace, pers. comm. 1999). See Figure 7 for the current WVNFS distribution across the MNF.

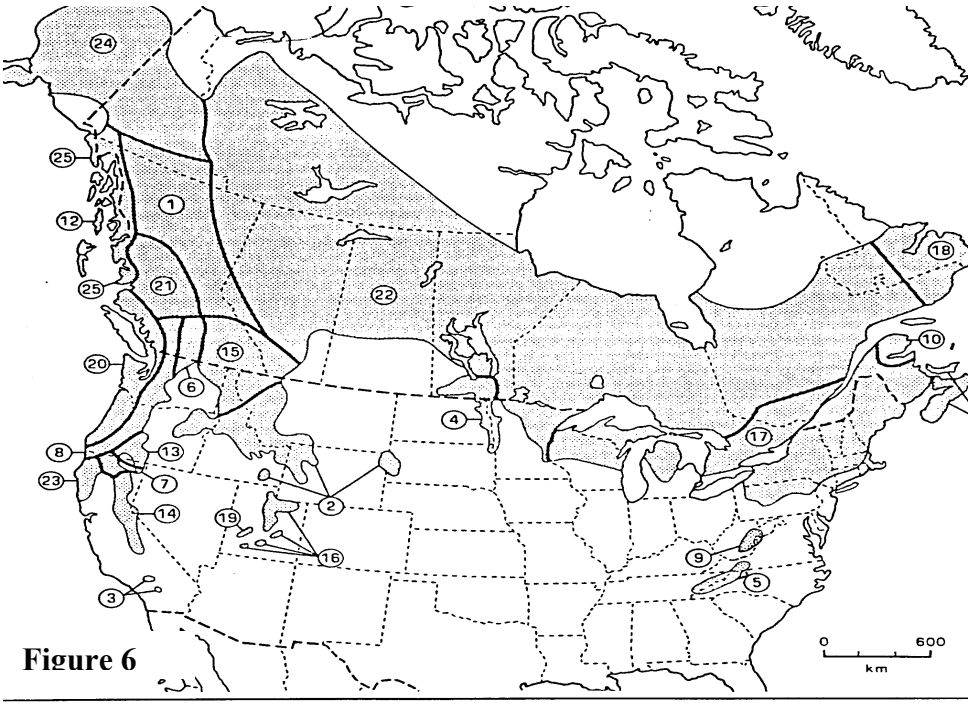


Figure 6

Numbers 5 and 9 indicate G.s. coloratus and fuscus respectively. Other subspecies are as follows: 1) G.s. alpinus, 2) G.s. bangsi, 3) G.s. californicus, 4) G.s. canescens, 6) G.s. columbiensis, 7) G. flaviventris, 8) G.s. fuliginosus, 10) G.s. goodwini, 11) G.s. gouldi, 12) G.s. griseifrons, 13) G.s. klamathens 14) G.s. lascivus, 15) G.s. latipes, 16) G.s. lucifugus, 17) G.s. macrotis, 18) G.s. makkovikensis, 19) G.s. murinauralis, 20) G.s. oregonensis, 21) G.s. reductus, 22) G.s. sabrinus, 23) G.s. stephensi, 24) G.s. yukonensis, 25) G.s. zaphaeus. Modified from: Wells-Gosling and Heaney (1984).

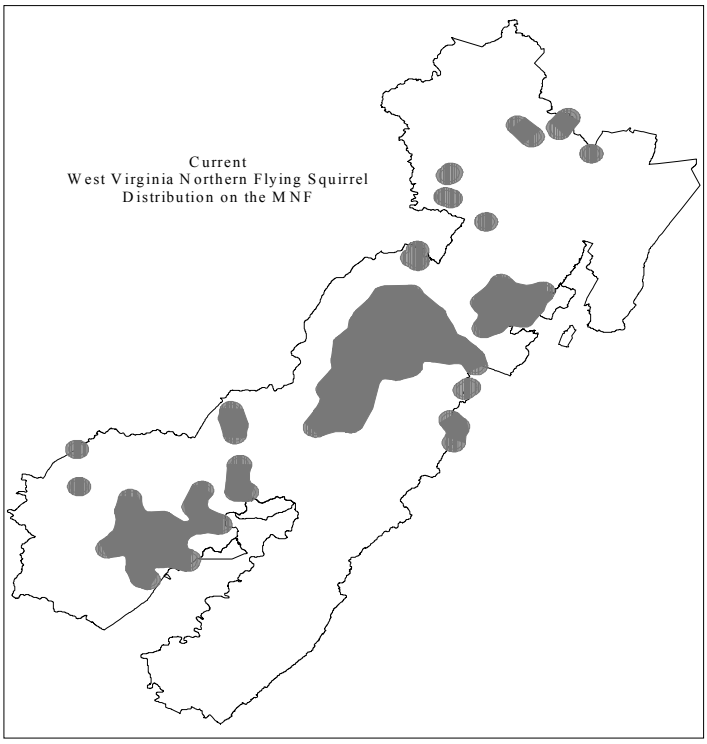


Figure 7. **Current Distribution of WVNFS on the Monongahela National Forest**.

REPRODUCTION

Mating occurs in late March through May for northern flying squirrels (Wells-Gosling and Heaney 1984). Gestation requires 37 to 42 days (Muul 1969, Soper 1973 in Wells-Gosling and Heaney 1984). Young usually are born in late May through June (Wells-Gosling and Heaney 1984); however, nestlings have been found in West Virginia in August and September (Wallace pers. comm. 1999). Litters typically contain 2-4 young (Rust 1946 in Wells-Gosling and Heaney 1984). Some studies suggest northern flying squirrels may produce 2-3 litters per year (Wells-Gosling and Heaney 1984), but WVNFS probably only produce 1 litter in the spring or summer (USFWS, 1990).

Young begin walking and emerging from the nest at 40 days of age (Muul 1969 in Wells-Gosling and Heaney 1984), and soon begin to eat solid food (Wells-Gosling and Heaney 1984). While they are weaned by 2 months (Booth 1946, Jackson 1961 in Wells-Gosling and Heaney 1984), young may remain with their mother for some time (Wells-Gosling and Heaney 1984). Normal lifespan is probably less than 4 years (Jackson 1961 in Wells-Gosling and Heaney, 1984).

FOOD HABITS

Food includes acorns, hazelnuts, beechnuts, and other nuts, conifer and hardwood seeds, buds, staminate cones (Conner 1960, Jackson 1961 in Wells-Gosling and Heaney 1984), wild fruits, and insects (Bailey 1936, Foster and Tate 1966, Jackson 1961 in Wells-Gosling and Heaney 1984), tree sap (Foster and Tate 1966, Schmidt 1931 in Wells-Gosling and Heaney 1984), fungi (both hypogeous and epigeous), lichens (Wells-Gosling and Heaney, 1984; WVDNR 1997; USFWS 1990), and other plant and animal material (WV Nature Notes undated). Fecal samples of WVNFS captured in West Virginia indicate the most common foods eaten were lichens, fungi (mostly underground/ hypogeous), pollen and insects (Stihler 1994).

GENERAL HABITAT CHARACTERISTICS

Northern flying squirrels have been captured in stands of various ages, understories, densities, and species composition, but most have been in moist forests with some widely-spaced, mature trees, abundant standing and downed snags (USFWS 1990, WVDNR, 1997), usually with some conifer (spruce, hemlock, fir) present (Stihler, 1994b). These habitats seem well suited to WVNFS' gliding locomotion, cavity nest requirements, and reliance on wood-borne fungi and lichens for food (USFWS, 1990).

In the southern Appalachians, WVNFS commonly are captured in and apparently prefer conifer/hardwood ecotones or mosaics dominated by red spruce and fir with hemlock, beech, yellow birch, sugar maple or red maple, and black cherry associates. Understory components were not thought to be significant indicators of general northern flying squirrel habitat (USFWS, 1990; Payne et al., 1989). However, WVNFS have been captured in northern hardwoods with conifer in the understory (Stihler 1995), indicating understory composition may play a greater role as a habitat indicator for this subspecies than previously thought.

WVNFS occupy tree cavities in cooler seasons, but they often use shredded bark or leaf nests located well above ground in the summer (Whitaker and Hamilton 1998). A telemetry study of WVNFS by Urban (1988) found that outside nests were located on conifers. Nests usually are lined with lichens, grasses, moss, leaves, or finely shredded bark (WVDNR, 1997).

HABITAT ON THE MONONGAHELA NATIONAL FOREST

Since the subspecies was listed, 878 captures have been documented in WV through July 1999 (Stihler and Wallace 1999); 97% of these captures have occurred on MNF lands. In general almost all WVNFS captures in WV have been associated with red spruce and mixed red spruce/northern hardwood forest types (Stihler et. al 1995). State-wide capture percentages were 30.1% in stands with ≥50% red spruce, 32.1% in stands containing 25-50% red spruce, 36.6% in stands containing 0-25% red spruce, and 1.2% in Norway spruce plantations (Ibid). All sites were above 2,750 ft elevation (WVDNR unpub data). Capture areas with no overstory red spruce had overstory eastern hemlock or balsam fir, with red spruce usually present in the understory or nearby (Stihler et. al. 1995).

On the MNF, approximately 299,400 non-Wilderness acres contain conifer or a conifer mixture in the forest. Approximately 23,500 of these acres are in MPs prohibiting commercial timber harvesting. Wilderness areas within the MNF also provide additional, protected habitat. Exact acreage of lands containing a conifer component in the understory or overstory within the wilderness is not known due to the lack of stand data.

CAUSES OF PAST/CURRENT DECLINE

All but approximately 200 acres of West Virginia's original 500,000 acres of red spruce were eliminated by timbering between 1880's –1920s. About 20% of these original red spruce stands have regenerated back to red spruce, but not all of these stands have attained the maturity characteristic of good flying squirrel habitat. Beyond direct habitat changes, historical logging also may have favored WVNFS competitors and pathogens via hardwood range expansion. WVNFS may be displaced by the more aggressive southern flying squirrel (*G. volans*) in certain overlapping hardwood habitats, and it may transmit the parasite *Strongyloides robustus*, which may be fatal to WVNFS (USFWS, 1990). However the Stewart Knob population of WVNFS have coexisted with southern flying squirrels for nearly 20 or more years with no apparent deleterious effects to either species.

The greatest immediate threats to WVNFS as identified in the RP are habitat destruction, fragmentation, or alteration associated with forest clearing; mineral extraction; and recreational and other land clearing development. Spruce and spruce-fir declines from acid precipitation and heavy metal pollution threaten to further reduce the range and quality of remaining conifer-hardwood habitats. Lichens and fungi accumulate lead, so WVNFS food sources also may be affected deleteriously (USFWS, 1990). Because of the squirrel's small size, the climatic severity of its habitat, and the abundance of avian and mammalian predators, secure nesting sites represent a critical limiting factor (USFWS, 1990).

WVNFS is now known to be more abundant and widespread than thought at the time of listing, based upon nest box and live trapping surveys. Five hundred twenty-five WVNFS were captured from 1985-1993. At that time WVDNR requested USFWS to review the endangered status of WVNFS to determine if downlisting to a threatened status was warranted. The basis for this request was that while preferred habitat (red spruce/northern hardwoods) restricts its range, the subspecies is not in danger of becoming extinct in the foreseeable future (Stihler, 1994). Completion of this review is pending.

FOREST PLAN STANDARDS AND GUIDELINES PERTINENT TO WVNFS

The Forest Plan directs that recovery plan management and implementation will be coordinated with WVDNR, universities, Forest Service research, USFWS, and the Heritage Foundation, as stated in current agreements, memorandums of understanding, or law (Forest Plan, page 52).

Appendix X of the Forest Plan provided interim standards and guidelines for considering WVNFS in MNF management activities and was developed in consultation with USFWS and WVDNR. This amendment **states that modification to these guidelines may be made after consultation with USFWS to comply with the recovery plan or to reflect new research data** (emphasis added).

The following several sections describe the 1990 RP, the RP as amended (2001) and Forest Plan guidelines. Modifications were recommended as a result of new knowledge and reevaluating MNF management activities with USFWS and WVDNR during this Biological Assessment process.

Recovery Plan

In 1990, the Recovery Plan (RP) for WVNFS was approved. It defined **occupied habitat** as any area where WVNFS is known to exist through positive identification, as through trapping. It defined the size of the occupied area as all area within a 0.5-mile radius of the trapping or identification site. These 0.5-mile buffers are applied to all known locations regardless of habitat type.

Within occupied habitat, options included redesigning the project to avoid the area or consulting with USFWS to determine appropriate mitigation measures. Examples of appropriate mitigation measures are listed in Appendix A of the Recovery Plan.

The 1990 RP also defined **potentially occupied habitat as follows:**

1. All stands containing spruce or fir […Region 9 timber types 11, 13, 17, 87] or

2. All stands above 3300 feet containing hemlock or northern hardwoods in any combinations […Region 9 timber types 81, 82, 85, 86, 89],
   and

3. Stands with at least some 10 inch dbh or larger trees present, and at least partial canopy closure (e.g. in mixed conifer/hardwood stands a minimum basal area of 100 square feet per acre.

The RP further outlined factors to determine if the area has **high or low potential suitability** (RP Appendix A). If the evaluation indicates high potential suitability, the following options are available:

1. Redesign the project to avoid the area.

2. Establish reasonable evidence that the area is unoccupied by WVNFS through the use of live trapping, and/or nesting boxes. Trapping and/or use of nesting boxes must follow procedures presented in Appendix B (of the RP) and must be supervised by a wildlife biologist. *

3. Consult with a wildlife biologist to determine appropriate management measures. Examples of such measures are listed in Appendix A of the RP. (USFWS 1990)

*Results in two subset definitions: **1) potentially occupied-high suitability: determined to be occupied (hereafter referred to as determined occupied)** and **2) potentially occupied-high suitability: determined to be unoccupied (hereafter referred to as determined unoccupied)** (Footnote added).

If the area is determined to be low, the area may be treated as **unoccupied**. In unoccupied habitat both the RP and the Forest Plan allow management activities to occur unconstrained by WVNFS concerns.

Recovery Plan Amendment

Working collaboratively with USFWS and WVDNR in assessing post-recovery plan (1990) data on additional captures and associated habitat elements on this subspecies, biologists noted that some aspects of the potential habitat definition found in the 1990 RP, and tiered to the FP, have changed. For example, WVNFS have been captured below 3,300 feet. Therefore, this limit is no longer considered when determining potential habitat. WVNFS captures have also occurred in stands with a low percentage of conifer in the overstory, or with a conifer component in the understory only, versus at least 10% conifer component in the overstory as previously used. Also, based on capture information the MNF now considers almost all forest habitat with red spruce and mixed red spruce/northern hardwood forest, Norway spruce plantations, and overstory eastern hemlock or balsam fir with red spruce present in the understory as suitable habitat for the WVNFS.

As an outcome of this collaborative effort, USFWS amended the Appalachian Northern Flying Squirrels (*Glaucomys sabrinus fuscus) (Glaucomys sabrinus coloratus)* Recovery Plan (USFWS 1990) for WVNFS on September 6, 2001. Modifications to the RP include: 1) defining habitat for the subspecies based on accumulated capture information collected since the subspecies was listed; 2) shifting the emphasis within the standards and guidelines section of the recovery plan from a "buffered site of occupancy" approach to protections founded upon definable, mapped habitat delineation based on ecological needs and preferences of the subspecies. This method is preferred over the former practice of delineating habitat based on 0.5 mile radius from a capture site, which may in fact include ecologically unsuitable habitat or miss potentially occupied areas. It also avoids the uncertainty associated in providing reasonable evidence that the area is occupied or unoccupied by WVNFS.

To meet requirements under ESA Section 7(a)(1), Section 7 (a)(2), and the FP, the MNF will implement this broader, habitat-based approach as directed by the RP as amended in order to enhance recovery of the WVNFS on the Forest. The MNF will continue to work with WVDNR, USFWS and research institutions to further refine habitat definitions and mapping to as accurately as possible reflect subspecies ecological requirements and to ensure that all potential habitats for this subspecies are considered. This approach better serves the subspecies by not relying absolutely on presence/absence data to determine occupied habitat. Projects are analyzed on the impacts to the habitat and to the species regardless of whether the habitat can be determined to be occupied or not.

Within the updated RP two habitat definitions are defined.

> **Suitable WVNFS habitat** is defined as areas that have the habitat characteristics required by WVNFS as indicated by known capture locations and the assumption is that WVNFS may potentially be present (USFWS 2001). Generally, it includes forest habitat with red spruce and mixed red spruce/northern hardwood forest, Norway spruce plantations, mixed eastern hemlock/northern hardwoods, and overstory eastern hemlock or balsam fir with red spruce present in the understory. Suitable habitat also includes buffers of approximately 150 feet where appropriate and corridors to provide linkages for habitat areas to prevent barriers to movement.

Unsuitable habitat does not currently contain necessary habitat components for the subspecies. Consequently; management activities planned in unsuitable habitat will not affect the WVNFS and will not require consultation or permits pursuant to ESA (USFWS 2001).

Allowable management activities are guided by the habitat definition for the area of the proposed activity. Because WVNFS is assumed to be present in **suitable habitat,** the emphasis will be on protecting this habitat. No projects, with the exception of USFWS approved research, or those projects that the type or scope of the project would result in a no effect or may affect, not likely to adversely affect determination in a biological evaluation, with concurrence from USFWS, are allowable.

Research oriented project emphasis will be on studying life history requirements; habitat enhancement measures, determining timber harvest methods that are compatible with protection and maintaining WVNFS populations and similar actions. Numbers and kinds of research projects will be limited by requirements of the Endangered Species Act. Once a study plan is complete, the MNF will consult with USFWS under ESA, Section 10(a)(1)(A) if needed.

Unsuitable habitat does not currently have any of the habitat components preferred by the WVNFS and must therefore, be assumed to be unoccupied by the WVNFS. In unsuitable habitat, vegetation management in areas that have the ecological potential to become suitable habitat would emphasize projects to maintain or improve WVNFS habitat characteristics. Projects may proceed in all other areas of unsuitable habitat unconstrained by WVNFS concerns. Survey work will not be required to determine occupancy of habitat.

This approach consequently promotes the recovery of WVNFS by reallocating resources from clearance surveys and mitigations, to emphasizing increased monitoring of populations and habitat enhancement. Monitoring for the subspecies is still essential and will continue. However, rather than focusing on project clearance as is currently applied, monitoring emphasis will be placed on a larger geographical recovery area (GRA) scale to monitor populations and further refine habitat definitions. This approach reduces or eliminates the amount of time and resources needed to survey project areas prior to project implementation (as projects that are jointly determined to have adverse effects on the species are only allowable outside of delineated habitat) and redirects this effort toward broader population monitoring and habitat protection. This method also facilitates analyzing the effects of a project at larger scales in addition to the project specific analysis.

Given that approximately 90% of WVNFS habitat in WV is on the MNF, by implementing this approach the MNF will contribute to the short and long-term recovery of the subspecies, consistent with the objectives identified in the purpose and need of this Biological Assessment, the FP, the RP as amended, and Sec.7 (a)(1) of the ESA.

Finalization of habitat definitions, mapping, and monitoring design will be done collaboratively with USFWS, WVDNR, and FS wildlife biologists and will be reviewed on a periodic basis

Effects of Continued Implementation of the Forest Plan
Programmatic effects have been analyzed based upon the amended Recovery Plan. All proposed project sites will be reviewed prior to project implementation to determine if they are in suitable or unsuitable WVNFS habitat as mapped. A biological evaluation is completed to analyze the effects of the proposed project. Projects may be approved for implementation if a "may affect, not likely to adversely affect" or a "no effect" determination is concluded for the project and the MNF receives concurrence by USFWS.

Allowable management activities will be guided by the habitat definition for the area as discussed above.

Regeneration Harvest

Potential direct effects include felling of cavity trees containing squirrel nests during regeneration harvesting. Adults may escape injury, but nesting young most likely would not. Because WVNFS are nocturnal, no other direct effects by equipment would occur. Equipment noise could disrupt nesting squirrels, possibly causing them to leave the nest, exposing them to daytime predators.

Indirectly, regeneration harvesting could decrease habitat by: 1) removing potential nest cavity trees; 2) maintaining or changing forest types to those less suitable for WVNFS dependent upon silvicultural prescriptions applied; 3) disrupting fungi/lichen growth, thereby, decreasing food availability; 4) eliminating "travel" trees used in gliding. If habitat is removed or degraded, squirrels could migrate to other available habitat; however, if other habitat were already occupied, competition for nesting cavities, food, etc. would increase.

Regeneration harvest is not allowed in suitable habitat. Exceptions to this would only occur on a case-by-case basis with approval from USFWS as discussed above. Thus no direct effects are anticipated to occur.

In unsuitable habitat, silvicultural guidelines would emphasize habitat enhancement in areas that have the ecological potential for WVNFS. Because these areas are at present considered unsuitable no direct effects are anticipated.

Indirectly regeneration harvest with silvicultural prescriptions that improve conditions could be beneficial to the subspecies by increasing the amount of suitable habitat into the future. In those areas considered unsuitable and do not have the ecological potential for the subspecies no indirect effects are anticipated.

Thinning and Single Tree Selection

Thinning and single tree selection have the same potential direct effects as Regeneration Harvest.

Indirectly, thinning and single tree selection could enhance residual overstory and understory tree growth, and result in faster attainment of desirable habitat characteristics. Temporary canopy openings created by thinning could encourage dense undergrowth and provide additional cover from predators during ground foraging. Widely spaced, large residual trees could benefit WVNFS by providing easier travel through the forest. Silvicultural prescriptions for thinning and single tree selections that favor release of conifer component, can also benefit WVNFS habitat suitability.

Thinning designed to release hard-mast species could encourage an influx of southern flying squirrels given their preference for this food type. Nesting site and food competition could result. Temporary canopy openings could also alter microclimates and decrease lichen and fungal food-source availability.

The MNF will continue to work with USFWS in agreed upon areas (see previous discussion) to enhance habitat through thinning and single tree selection. Based on this there is little chance of direct, indirect or cumulative effects of this activity negatively impacting the subspecies. Indirectly, this activity may prove to be beneficial to the subspecies.

In unsuitable habitat there will be no direct effects. Indirect effects will be equivalent to those as discussed in the regeneration section.

Timber Stand Improvement

Since, small diameter trees (8 inches dbh and less) and vines are cut during TSI on the MNF; it is unlikely that cavity trees that could be utilized by WVNFS would be removed. Large trees, which are more likely to have cavities, are not removed. Undergrowth and vine removal could enhance predation of WVNFS when ground foraging, but during most TSI operations spruce is not cut (Blodgett, pers. comm. 1999; Juergens, pers. comm. 1999) to avoid negatively affecting future spruce stocking.

Occasionally herbicides are used for TSI. The MNF has averaged approximately 100 acres per year of herbicide treatment for TSI. Most of this work has been used to release oak trees and has not been completed in potential WVNFS habitat.

Because TSI would not normally occur in suitable habitat, no direct, indirect or cumulative effects are likely. Based on vegetation management guidelines TSI in areas with the potential to become ecologically suitable may increase suitability of this habitat for future occupancy by WVNFS. TSI in other unsuitable habitat is not restricted and would not have negative direct, indirect or cumulative effects.

Prescribed Fire

Prescribed burning on the MNF has been limited to a few grassy/herbaceous openings for wildlife habitat improvement and understory burns to promote oak regeneration. Future burns may occur in some oak-hickory forest types. Neither grassy/herbaceous openings nor oak-hickory forest types provides WVNFS habitat (Stihler, pers. comm. 1999), so direct effects have not occurred.

Prescribed burns generally are done in March/April on the MNF and northern flying squirrel young usually are born in late May through June (Wells-Gosling and Heaney 1984), nesting young probably would not be present during burning. Smoke from burns in adjacent areas could enter WVNFS habitat, but adult WVNFS could avoid the smoke.

Cumulatively, due to the low number of prescribed fires and acres treated on the MNF, the effects of prescribe fires are minimal and therefore discountable.

Prescribed burns will not normally occur in suitable habitat unless the proposed burns meet research or enhancement criteria. Thus no direct effects will occur unless under a research permit.

In unsuitable habitat, guidelines for prescribed burning in areas with the ecological potential to become suitable will emphasize improvement or enhancement of habitat for WVNFS. This should eliminate most negative impacts to future habitat. Prescribed burning in other unsuitable habitat would have no direct effects on the subspecies. Indirect effects of prescribed burning would be minimal due to the limited acreage burned and the emphasis for habitat improvement within these areas.

Firewood Cutting

WVNFS habitat that is in wilderness, botanical, recreation or active timber sale areas is protected from firewood harvest. Firewood cutting on the MNF is allowed in all areas outside of these areas.

On the MNF firewood cutting is restricted to the removal of dead and downed trees only. WVNFS are not known to nest in downed trees therefore firewood cutting would not directly affect the subspecies.

Dead and downed wood removal could decrease future fungi and lichen growth because their growth media is removed. However, firewood removal generally is concentrated along open roads, which limits the extent of potential indirect effects across the MNF.

Firewood cutting is proposed as an acceptable programmatic project within suitable habitat that may affect, but is not likely to adversely affect WVNFS. Given concurrence from USFWS no additional guidelines on firewood cutting in suitable habitat would be established. Based on past and current permit levels and the limited spatial context of this activity, cumulative effects are considered minimal.

Gypsy Moth

Gypsy moth defoliation and control spraying have been and will continue to be restricted primarily to oak-dominated stands on the MNF. WVNFS does not occur in these stands (Stihler, pers. comm. 1999); consequently, WVNFS will not be directly, indirectly, or cumulatively affected by gypsy moth defoliation or treatment.

Road Construction/Reconstruction

Tree cutting for road construction has the same potential effects as Regeneration Harvest. Because WVNFS are nocturnal, and most MNF forest-road use occurs during the day, death or injury to WVNFS from collision with vehicles is highly unlikely given current levels of road use on the MNF.

Road construction/reconstruction have the same indirect effects as Regeneration Harvest. Additionally, roads could increase WVNFS predation by providing travel ways for predators such as raccoons.

Road construction would not normally occur in suitable habitat. Limited exceptions to this may be made for research related projects or other projects (i.e. related to gas well development, access to private lands, etc.) approved after consultation with USFWS. Road construction would not be restricted in unsuitable habitat. This could indirectly impact areas with the potential to become suitable; however the chances of this are minimal based on past and current road construction levels. In other unsuitable habitat no effects are anticipated.

Limited road reconstruction and maintenance are proposed as acceptable programmatic projects within suitable habitat that may affect, but are not likely to adversely affect WVNFS. Given concurrence from USFWS no additional guidelines on road reconstruction and maintenance in suitable habitat would be established. Cumulative effects are considered minimal.

Recreation

Because WVNFS are nocturnal, recreation disturbances from hiking, backpacking, hunting, fishing, camping, mountain biking, etc. would not directly affect WVNFS at current or anticipated levels identified in the FP. Trail or recreational site development could require removal of potential nest cavity trees and trees for gliding.

Recreational use could increase WVNFS predation by providing travel ways for predators. However potential indirect effects at current use levels are considered minor.

No known proposals exist for major recreational site development on the MNF or adjacent private lands within the next five years (Kerr, pers. comm. 1999), so cumulative recreation effects are discountable.

Recreation improvement projects would not normally occur in suitable habitat. Also, no major recreational site development is planned on the MNF within the next 5 years. Therefore, overall there is little chance of impacting WVNFS and effects are considered discountable.

In unsuitable habitat no direct effects are anticipated. With the limited level of current trail construction/reconstruction, current recreational use levels, and predicted major recreational site development there is little chance of impacting areas with the potential to become suitable habitat. Therefore, it is unlikely that recreation improvements would preclude these areas from becoming suitable WVNFS habitat in the future. In other unsuitable habitat, recreation development is not restricted and no effects are anticipated.

Wildlife Habitat Improvements

Tree removal for wildlife openings or savannas has the same potential direct effects as Regeneration Harvest. However, creation of MNF wildlife openings has been decreasing, and district wildlife biologists generally avoid WVNFS habitat when planning wildlife habitat improvements.

When surveying for WVNFS presence, nest boxes are placed in an area for monitoring. Following monitoring, nest boxes are left in place to provide additional nesting cavity habitat resulting in a potential positive effect.

Wildlife improvement projects such as those identified in the introduction generally will not occur in suitable habitat. Exceptions (i.e. nest box placement, monitoring, and WVNFS related research projects.) will only be allowed with approval from USFWS. Projects may proceed in unsuitable habitat as long as they do not preclude the future suitability of habitat for WVNFS. Based on this process, no adverse effects are anticipated.

Fisheries Improvements

All fisheries improvement projects go through the same review process and determination as identified in previous activities.

Stream liming, large wood placement and erosion control would not affect WVNFS. Fisheries improvement has been proposed as an acceptable programmatic project within suitable habitat.

Cutting trees for woody debris placement in streams would have the potential for the same direct effects as Thinning and Single Tree Selection. There could be temporary canopy openings created from tree cutting to obtain large pieces of wood, but usually only 1 tree per 75-100 ft. of stream is cut. This temporary single-tree canopy opening would not change the microclimate sufficiently to affect fungi or lichen growth, and therefore would not affect WVNFS food supply. On overage only 2 miles of stream per year are treated with woody debris placement. Therefore the effects of fisheries management are discountable.

Range
Range allotments on the MNF are typically in open areas therefore, livestock grazing does not affect WVNFS habitat. Thus, range management does not directly, indirectly, or cumulatively affect WVNFS.

Mineral Activity
Clearing trees for gas or coal development activities and road access has the same potential direct effects as Regeneration Harvest. The indirect effects would be the same for Road Construction/Reconstruction.

Natural gas development has been and is likely to continue to be proposed in WVNFS habitat. All projects to date have been redesigned to avoid impacts. In one instance, a gas pipeline was allowed in WVNFS habitat, but within that habitat the pipeline was buried in the road right-of-way clearing resulting in no loss of habitat.

Mineral development activities will normally not occur in suitable habitat. Exceptions may occur (i.e. well pads, pipelines, activities associated with private subsurface ownership, etc.) and will only be allowed after consultation with USFWS. Projects may proceed in unsuitable habitat as long as they do not preclude the future suitability of habitat for WVNFS. Based on this information, the chance of impacting WVNFS is discountable.

Programmatic Activities

Other activities not described in the management activities above may be implemented in suitable habitat as they have such a small chance of impacting an individual WVNFS and such minimal effects to squirrel habitat that they are considered "no effect" or 'may affect, not likely to adversely affect" projects. These projects include: campground maintenance; hazard tree removal; trail construction, reconstruction and maintenance; individual spruce tree removal on powerline ROW; gypsy moth spraying; other forest products collection; wildlife habitat maintenance; facility maintenance; mineral site improvement; mine site reclamation; cathodic activities; and small (<1/4 acre) vista creation.

SUMMARY OF CUMULATIVE EFFECTS

Because >90% of West Virginia's WVNFS habitat is on the MNF (Stihler 1999), timber harvests and other development outside the MNF should not have a significant cumulative effect on WVNFS. Indirectly, industrial activities outside of the MNF could lead to increased levels of acid rain. Acid rain and spruce/hemlock adelgid infestations could reduce future MNF conifer abundance, but their current impacts to WVNFS habitat are unknown.

As stated earlier the MNF has approximately 299,400 non-Wilderness acres that contain conifer or a conifer mixture in the forest. Approximately 23,500 of these non-Wilderness acres are in MPs prohibiting commercial timber harvesting. Although exact acreage of Wilderness areas containing suitable WVNFS habitat is not known due to the lack of stand data, Wilderness areas within the MNF also provide additional protected habitat.

Vegetation management activities would not be allowed in suitable habitat with the exception of research permitted activities that enhance the recovery of the subspecies and/or determining compatible uses. Numbers and kinds of research projects will be limited by requirements of ESA as such cumulative effects would be minimal. These studies and increased population monitoring will assist overall understanding of WVNFS habitat requirements and management impacts to the subspecies.

All projects in suitable WVNFS habitat will be analyzed by a wildlife biologist to determine cumulative effects on WVNFS.

In unsuitable habitats that have ecological potential for WVNFS, vegetation management activities will emphasize habitat improvement and availability for the subspecies. Cumulatively, this emphasizes long-term recovery of WVNFS and will not further limit and may indeed expand the current distribution or range of the subspecies on the MNF.

This approach emphasizes looking at effects on a larger scale, both temporally and spatially, instead of project specifically. Further reducing some immediate threats identified for the species in the recovery plan including: habitat destruction, fragmentation, and habitat alternation associated with forest clearing. Cumulatively, this should assist in the long-term recovery of WVNFS.

SUMMARY OF POTENTIAL EFFECTS TO WVNFS

Potential Beneficial Effects:

1. Increased programmatic emphasis on recovery of the species.

2. Mapping of suitable habitat and defining compatible activities.

3. Research activities associated with further refining life history requirements and habitat preference.

4. Research directed habitat enhancement measures within suitable habitat.

5. Monitoring efforts with USFWS, WVDNR and research institutions to study WVNFS response to various habitat modification measures.

6. Using vegetation management to release and promote conifer regeneration and growth in unsuitable habitat to provide for future WVNFS habitat.

7. Increased monitoring of Geographical Recovery Area and Forest-wide: populations.

Potential Adverse Effects:

1. Allowing mineral development in WVNFS habitat.

DETERMINATION

As a result of implementing the WVNFS Recovery Plan as amended, a MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for regeneration harvest, thinning and single tree selection, TSI, road construction/reconstruction, recreation, fisheries improvements, prescribed fire, firewood cutting, wildlife habitat improvements and mineral activity. A NO EFFECT determination is made for gypsy moth and range.

MEASURES TO MINIMIZE POTENTIAL ADVERSE EFFECTS TO WVNFS

1. Work with USFWS to ensure that the written definition of WVNFS habitat stays current and is incorporated into all programmatic and project work.

2. Work with WVDNR and USFWS to determine how management needs to be changed to provide better or additional WVNFS habitat; e.g., timber harvests to release conifer/yellow birch, thinning to provide areas with large, widely spaced trees.

3. Revise Forest Plan Appendix X as needed based on Recovery Plan Amendments.
4. Continue to monitor WVNFS habitat and potential habitat through the placement of WVNFS nest boxes or other acceptable means.

RUNNING BUFFALO CLOVER

Running buffalo clover (*Trifolium stoloniferum*) (RBC) was listed as endangered on July 6, 1987. A recovery plan was completed in June 1989 (USFWS 1989). Recovery plan revision and possible downlisting to threaten has been proposed for RBC. West Virginia Natural Heritage Program considers RBC to be "critically imperiled in West Virginia" (S1) (Harmon and Mitchell 1999).

DISTRIBUTION

RBC formerly grew over a broad area of West Virginia, Ohio, Kentucky, Indiana, Illinois, Missouri, Kansas, Nebraska, and Arkansas (Cusick 1989). Once widespread and commonly found along streams and bison trails, the species range is now restricted to West Virginia, Kentucky, Indiana and Ohio (Ostlie 1990). The species is considered extirpated from much of its historical range (Ostlie 1990). RBC populations range from 1 to 100,000 individuals. In West Virginia, a total of eighteen wild populations, eleven of which are on the Monongahela National Forest, are monitored annually (Harmon and Mitchell 1999).

REPRODUCTION

Running buffalo clover is a stoloniferous perennial that spreads by seed and stolon. It is the only *Trifolium* clover not known to have a rhizobial associate. RBC is believed to be self-fertile. It is capable of self-pollination. Insect pollinators for RBC are believed to be bees (P. Harmon pers. comm. 1999).

Flowers are produced from April-June and seeds are set from May-July. Seed scarification is essential for germination. RBC is very palatable to herbivores and historically scarification resulted from ingestion by bison (Bison bison), white-tailed deer (Odocoileus virginianus), and eastern cottontail rabbits (Sylvilagus floridanus). Primarily deer accomplish scarification of seed. Herbivores, especially large free ranging ungulates, aided in the dispersal of RBC seed into different habitats (Pickering 1989). Occasionally, unscarified seed germination occurs in spring when daytime temperatures are 15-20°C and nighttime temperatures are 5-10°C (Ostlie 1990).

GENERAL HABITAT CHARACTERISTICS

Many botanists believe RBC is a savanna species dependent on slight disturbance for survival. Little is known about the original vegetation with which running buffalo clover was associated (Ostlie 1990) or specific system processes and disturbance regimes under which this species existed.

Existing RBC populations occur in floodplain forests, field edges (Bartgis 1985), old skid roads and ungravelled truck roads, cemeteries, open woodlands (WV Natural Heritage Program 1983), mowed parks, jeep trails, and hawthorn thickets (Cusick 1989). It prefers semi-shaded woods and depends upon slight levels of disturbance for survival. Natural populations do not occur in areas of full sun (Ostlie 1990). Evidence indicates RBC responds favorably to low levels of disturbance that occur during road construction, use, and abandonment (USFWS 1998); terrace farming; and 4-wheel vehicle disturbance (Concannon 1997 pers. obs.). Soil disturbance resulting from construction and use of a skidder trail and silvicultural treatments opening forest canopies so the road is exposed to sunlight are factors believed to be responsible for creating additional habitat for this species (Tolin pers. commun. 1998).

HABITAT ON THE MONONGAHELA NATIONAL FOREST

RBC has a high affinity for calcium-rich soil, which is abundant throughout the MNF, especially where Greenbrier limestone reaches to the surface. Prior to it listing, RBC was known at only 2 West Virginia sites. Approximately 120,000 project acres (48560 ha) have been analyzed and/or surveyed for RBC in the past 10 years. Through those surveys, RBC populations have been found on the Cheat/Potomac and Greenbrier districts, occupying many of the RBC habitat types described above. Today, RBC is known on 11 MNF sites, with approximately 107,000 individuals. These populations contribute significantly to the viability of this species.

No designated critical habitat exists on the MNF for RBC (USFWS 1989).

CAUSES OF PAST/CURRENT DECLINES

Reasons for the historic decline in RBC are unclear. Past RBC declines have been attributed to habitat loss from increased forest canopy closure, declines in bison herds, habitat clearing, and non-native species competition. Diseases from other clovers, pollinator loss, and changes in fire regime (currently less frequent, larger scale, and greater intensity) may also have contributed to RBC declines. However, these mechanisms are speculative and research is needed to learn more about RBC's reproductive and survival requirements.

Current threats to RBC have been identified as:

Direct loss of habitat; reduced ground disturbance and permanent loss of disturbed woodlands along streams and terrace areas due to highway/road construction, agricultural conversion and urban development

Habitat fragmentation. RBC original habitat, open woods along streams, is still declining due to agricultural conversion and plant succession (Bloom 1989).

Competition from non-native plants. RBC does not compete successfully with more aggressive exotic species, such as white clover (*Trifolium repens L.) (*Jacobs and Bartgis 1987).

Altered natural disturbance regime. Reduced fire frequency resulting in the loss of open woods (Campbell et al. 1988). With the elimination of large herbivores [bison] from the range of the clover, not only was the habitat lost but so were potential routes and mechanisms of dispersal (USFWS 1989). In contrast to nomadic grazing as displayed by bison, intensive localized livestock grazing can eliminate a population from an area.

FOREST PLAN STANDARDS AND GUIDELINES PERTINTENT TO RUNNING BUFFALO CLOVER

General Forest-wide *Page*

2670 h. Running buffalo clover. Survey broken canopied forest or non-forest areas to be affected by land transfer, repeated vehicular use, or earth disturbing activities. Examples of such areas are old home sites, woods roads, savannas, wildlife openings, grazing allotments, old log landings, and roadsides. Known running buffalo clover sites will be protected.....87

Appendix K
D1c(16) Threatened, endangered, and sensitive flora and fauna and their habitat will be protected. See Plan forest-wide standards and guidelines 2670, special zoological area standards and guidelines, namely Essential Habitat for Threatened and Endangered bats and Occupied Habitat for Virginia Northern Flying Squirrel (VNFS), Plan Appendices X (VNFS) and U (Sensitive Plant and Animal Species), and any recovery plans for threatened and endangered species K-15

D2b(8) No earth disturbance or vehicle use will be permitted at known locations of running buffalo clover..... K-17

EFFECTS OF CONTINUED IMPLEMENTATION OF THE FOREST PLAN

Current knowledge indicates RBC apparently needs slight disturbance to thrive, but the specific types and severity of disturbance are not well understood. Tree cutting for any activity could increase habitat suitability by opening up the overstory canopies. Limited ground disturbing activities could provide mechanical scarification of the seed and could provide an area for the species to disperse. Disturbance from Forest Plan activities could indirectly cause RBC to increase in population number and size on the forest.

Levels of disturbance that are beneficial to RBC are not fully understood. Research studies have been initiated on the Fernow Experimental Forest to fill this knowledge gap. Until more information is obtained, the MNF will continue to protect known populations, avoid ground-disturbing activities within known populations, and monitor populations. Exceptions to this would be on a case-by-case basis in consultation with the USFWS.

Regeneration Harvest, Thinning and Single Tree Removal, Timber Stand Improvement, Prescribed Fire, Road Construction/Reconstruction, Recreation, Wildlife Habitat Improvements, and Minerals Activity

Proposed projects of this nature are required to go through a project clearance process. Whenever these types of activities are proposed on the MNF, project areas are surveyed for RBC habitat. Projects may proceed where potential habitat does not exist. Project areas containing potential RBC habitat are surveyed for RBC presence. If RBC is not found, the project may proceed; if RBC is found, the project is redesigned or dropped to avoid potential effects. There will be no deliberate introduction of non-native plant species into known population or nearby areas by any of these activities. Consequently, implementing any of the above-mentioned activities is not likely to directly or indirectly affect RBC.

Firewood Cutting

Firewood cutting of dead and down trees is common on the MNF, especially along open roads. However, the number of firewood permits and miles of open roads are limited, so the probability of affecting RBC by firewood cutting is discountable. Only one known site of RBC is located along an open road. Furthermore, some firewood cutting and gathering occurs when RBC is dormant. Therefore, firewood cutting is not likely to directly, indirectly, or cumulatively affect RBC.

Gypsy Moth

Gypsy moth spraying on the MNF has been reduced greatly since the 1996 population collapse. Like other trifolium species, bees are believed to be the primary pollinator of RBC. Because Dimilin, Bt, and Gypchek target Lepidopteran species, these sprays are not anticipated to affected bee populations within spray areas. In addition Dimilin, B.t. or Gypchek spraying to control gypsy moth would not directly affect RBC because it can self-pollinate. Thus, effects to non-target pollinators would not be detrimental to RBC.

Fisheries Improvements

Fisheries management is not likely to directly or indirectly affect RBC because most fisheries improvements are done in the stream channel. Current and future water quality improvements have been primarily limited to liming streams, which does not affect RBC habitat. Because of the limited extent and frequency of structural improvements, removal of trees for this type of work is minimal therefore chances of affecting RBC habitat is discountable.

Range

Light to moderate grazing takes place on approximately 7,000 acres on the MNF. At these levels grazing may provide light soil disturbance and semi-open canopies that favor this species.

Although highly palatable to livestock, no known RBC populations exist within current allotments, and the future MNF range program is expected to remain similar to current levels. Therefore, RBC habitat changes are not expected from the MNF range program and range management is not likely to directly or indirectly affect RBC.

SUMMARY OF CUMULATIVE EFFECTS

Past and present MNF management activities are not likely to cumulatively affect RBC because potential-habitat surveys are done prior to implementing regeneration harvesting, thinning and single tree selection, TSI, prescribed fire, road construction/reconstruction, recreation, wildlife habitat improvements, and mineral activity. Maintaining permanent roads with deep gravel and heavy road maintenance (blading) could decrease potential RBC habitat.

Existing RBC populations are protected on the MNF from ground disturbing activities. Populations will continue to be protected until more information is obtained on disturbance levels needed to benefit RBC. Populations of RBC on the MNF will continue to be monitored. Potential effects from MNF fisheries management, firewood cutting, and gypsy moth control are not expected to cumulatively affect RBC due to the small scope and infrequency of these activities.

Furthermore, cumulative effects to RBC populations outside the MNF boundaries by ground-disturbing activities will be limited because most WV populations of RBC occur on the MNF.

Since no designated RBC critical habitat exists on the MNF, adverse modification or destruction of such habitat by continuing to implement projects under the current or amended Forest Plan will not occur.

SUMMARY OF POTENTIAL EFFECTS ON THE RUNNING BUFFALO CLOVER

Potential Beneficial Effects:

Activities with potential to benefit suitable habitat include those that result in less competition by other plants, scarification of seeds, light soil disturbance to create suitable seedbeds, and allow moderate sunlight to reach the ground.

1. Limited timber harvest that results in less dense canopies and small openings, prescribed burning, grazing or any other activity that favors early successional species on a small scale may increase habitat suitability by creating potential RBC habitat.

2. Some ground disturbing activities could provide mechanical scarification of the seed and could provide an area for the species to disperse.

3. Disturbance from Forest Plan activities could indirectly cause running buffalo clover to increase in population number and size on the forest.

4. Known populations on the MNF will continue to be monitored for health and vigor. Surveys may locate additional wild populations and provide additional information on this species.

Potential Adverse Effects:

1. Permanent roads with deep gravel could decrease potential RBC habitat.

2. Heavy road maintenance (blading) beyond light soil disturbance could decrease potential RBC habitat.

3. Timber harvest that results in large openings that allow significant amounts of sunlight to reach this species.

DETERMINATION

Based on the above information A MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for regeneration harvest, thinning/single tree selection, TSI, prescribed fire, firewood cutting, gypsy moth control, road construction/reconstruction, recreation, wildlife habitat improvements, fisheries improvements, range management, and minerals activity.

MEASURES TO MINIMIZE POTENTIAL ADVERSE EFFECTS TO RUNNING BUFFALO CLOVER

The following measures are proposed to strengthen the MNF's ability to protect and manage RBC habitat.

1. Update forest-wide standards/guidelines - 2670, IV, Threatened and Endangered Species, A.1. to include threatened and endangered plant species.

2. Continue to analyze potential projects for RBC habitat. Conduct surveys in potential running buffalo clover habitat before any potential project is implemented. Redesign potential projects to avoid negatively affecting RBC.

3. Continue monitoring efforts and implementing actions in the RBC Recovery Plan.

SHALE BARREN ROCK CRESS

Shale barren rock cress *(Arabis serotina)* (SBRC) was listed as endangered on August 14, 1989. USFWS completed a Recovery Plan in June, 1991.

DISTRIBUTION

SBRC is endemic to mid-Appalachian shale barrens in the Ridge and Valley Province of the Appalachian Highlands. There are 35 known SBRC sites in 10 Virginia and West Virginia counties (USFWS 1991). Nine of the 18 West Virginia sites are in Greenbrier County on endemic shale barrens in the Anthony Creek watershed on the Marlinton/White Sulphur District of the MNF (Harmon pers. comm. 1999).

REPRODUCTION

SBRC is a small mustard-family biennial. A basal rosette develops the first year, and an erect flower plant develops in the second year. While rosettes typically are absent in the second year, occasionally they persist. Precipitation or lack thereof can affect germination of dormant SBRC seeds stored in seedbanks. Dry summers often promote enhanced germination if spring rains were adequate.

Research on pollination and pollinator of SBRC is lacking, though the grizzled skipper (*Pyrgus wyandot*) and Olympia marble (*Euchloe olympia*), which inhabit shale barrens and adjacent woodlands, are known pollinators of SBRC (USFWS 1991). A dipteran of the family Syrphidae (flower flies) also may pollinate SBRC (Lipford 1987).

GENERAL HABITAT CHARACTERISTICS

Mid-Appalachian shale barrens generally are characterized by open (<10% canopy closure), scrubby pine (*Pinus* spp.), oak (*Quercus* spp.), red cedar (*Juniperus virginiana*), and woody species growing on dry, south-facing steeply-sloping (>20%) shale formations. Open herbaceous cover adapted to this harsh environment also can occur (USFWS 1991). Often the slope is undercut by a stream directly below the shale barren. In the mid-Appalachians, the shale formations are generally upper Devonian-age, though some are Ordivician- and Silurian-age (USFWS 1991).

HABITAT ON THE MONONGAHELA NATIONAL FOREST

Shale barrens are south- to southwest-facing, narrowly endemic sites on shale ridge balds. They exist on Devonian-age shales of the Brallier formation between 1300-2500 ft (396-762 m) elevations (Keener 1983). Some associates of shale barren rock cress include: shale barren evening primrose *(Oneothera arigicolla)*, redbud (*Cercis canadensis*), shale barren clematis (*Clematis albicoma*), scarlet oak (*Quercus coccinea*), white oak (*Quercus alba*), fragrant sumac (*Rhus aromatica*) and many others (USFS 1996).

Nine SBRC sites are known on the MNF: Lower White's Draft (2 small barrens), Meadow Creek, Middle Mountain, Turkey Pen, Whitman Draft, Rohrbaugh Run, Blue Bend, and Humphrey's Draft (USFWS 1988). The latter, found in 1989, is the most recently discovered site (Concannon pers. comm.).

Approximately 1000 ac (405 ha) of timber sale areas have been surveyed for shale barrens using site-specific geology and aerial photos. No SBRC have been found since the 1989 endangered listing. Potential and known habitat within the entire MNF (including project acres) is estimated to be less than 100 acres (45 ha).

No designated critical habitat for SBRC exists on the MNF.

CAUSES OF PAST/CURRENT DECLINE

The primary threats and causes of SBRC decline have been road and railroad construction, which have destroyed several known West Virginia and Virginia shale barrens (USFWS 1991). A flood control dam has detrimentally affected one population (USFWS 1991).

Deer herbivory may be a significant threat to SBRC, although supporting data are primarily circumstantial (USFWS 1991).

Goat and sheep grazing have caused the most destructive herbivory of SBRC in West Virginia (2 sites) (USFWS 1991). No sheep or goat grazing of shale barrens supporting SBRC has occurred on the MNF over the past 6 years.

Invasion of non-native species, such as knapweed, Japanese honeysuckle and brome grasses, contribute some of the biggest threats to SBRC populations (Harmon pers. comm. 1999). They have invaded several shale barrens and threaten their overall integrity. Cattle and humans disperse non-native plant species. Recreation, foot traffic, and population-monitoring procedures for SBRC (Concannon pers. obs) have caused inadvertent spread of non-native species into undisturbed shale barrens.

Dimilin and B.t. insecticides for gypsy moth control may threaten SBRC pollinators, but since little is known about SBRC pollinators no cause-and-effect relationships have been shown (USFWS 1991).

FOREST PLAN STANDARDS AND GUIDELINES PERTINENT TO THE SHALE BARREN ROCK CRESS

General Forest-wide *Page*

SBRC was not an endangered species in 1986, when the Forest Plan was signed. However, known shale barren sites were considered rare endemic sites and had been nominated for Botanical Area and Research Natural Area designation. The WV Natural Heritage Program was contracted to describe these areas. White's Draft and Meadow Creek Shale Barrens, which harbor SBRC were designated as Botanical Areas and also were recommended for protection as potential Research Natural Areas under Management Prescription 8.0. Pertinent Standards and Guidelines in the 1992 Forest Plan Amendment are:

2670 h. Shale Barren Rock Cress. The shale barren rock cress was listed as a federally endangered plant species in 1989. The Recovery Plan recommended the following guidelines:
- Prior to conducting any activity on National Forest System land within Greenbrier County, WV, surveys may have to be conducted to locate and identify shale barrens and shale barren rock cress populations. This guideline will be applied on a case-by-case basis in consultation with the USFWS 87
- Most Forest authorized activities (other than activities such as research/information gathering) are prohibited within shale barrens (i.e., shale barrens will be avoided). Exceptions to this standard will be decided on a case-by-case basis in consultation with the USFWS.....87

Appendix K
D1c(16) Threatened or endangered, and sensitive flora and fauna and their habitat will be protected. See Plan forest-wide standards and guidelines 2670, special zoological area standards and guidelines, namely Essential Habitat for Threatened and Endangered bats and Occupied Habitat for Virginia Northern Flying Squirrel (VNFS), Plan Appendices X (VNFS) and U (Sensitive Plant and Animal Species), and any recovery plans for threatened and endangered species K-15

D2b(7) No surface occupancy will be permitted in shale barrens, or known locations of shale barren rock cress K-17

EFFECTS OF CONTINUED IMPLEMENTATION OF THE FOREST PLAN

Regeneration Harvest, Thinning and Single Tree Removal, Timber Stand Improvement, Prescribed Fire, Road Construction/Reconstruction, Recreation, Wildlife Habitat Improvements, and Minerals Activity

Shale barren sites are limited on the MNF. All estimated 100 acres of known and potential SBRC habitat on the MNF are located on the Marlinton/White Sulphur district in Greenbrier County. In addition, most activities are prohibited on shale barrens; exceptions are given case-by-case in consultation with USFWS. Surveys for potential SBRC habitat are made prior to ground-disturbing projects. When potential habitat is identified, further surveys determine SBRC presence or absence. If SBRC is found, the project is dropped or redesigned to avoid potentially affecting SBRC. Consequently, recreation, wildlife habitat improvements, and mineral activity are not anticipated to directly or indirectly affect SBRC. Additionally, because SBRC habitat is usually steep, dry, and contains little or no marketable timber, these areas are not suitable for timber harvesting. This habitat also is unsuitable for range and fisheries improvements. Therefore, regeneration harvest, thinning /single tree selection, timber stand improvement (TSI), prescribed fire, firewood cutting, fisheries improvements, and range will not directly or indirectly affect SBRC habitat.

Gypsy Moth

The Gypsy Moth long-term non-target study is not expected to directly or indirectly affect SBRC because known MNF sites are south of the study sites.

In general, harsh SBRC habitat does not support gypsy moth, although adjacent woodlands may. Gypsy moth populations have been reasonably controlled naturally since 1996 by *Entomophaga maimaiga*, but defoliation increased on portions of the Forest in 2000. If areas adjacent to SBRC populations are proposed for spraying, Gypchek will be used to avoid any adverse effects on potential pollinators of this species. These measures should minimize any indirect effects of gypsy moth on SBRC.

Road Construction/Reconstruction

Road construction is extremely unlikely in shale barrens due to steep slopes, so direct effects to SBRC are not expected.

Road Construction or reconstruction near SBRC habitat could indirectly affect SBRC by providing a corridor for non-native plants to invade the shale barren. However, since only 15 miles of roads are constructed or reconstructed annually, and these usually are associated with timber sales, roads adjacent to shale barrens would be rare.

SUMMARY OF CUMULATIVE EFFECTS

Half the known WV SBRC sites occur on the MNF. SBRC populations on private lands are at greatest risk because private landowners are less likely to protect SBRC. Private-land grazing presents the largest threat.

On the MNF, known shale barrens, except Blue Bend, are intact. The MNF avoids planned activities on shale barrens. The Shale Barren Rock Cress Recovery Plan calls for monitoring the SBRC and associated endemic species on selected shale barrens. White's Draft and Blue Bend populations have been monitored biennially for the last 5 years. During this time, paths through the barrens have increased as a result of monitoring and recreational activities, non-natives have invaded, and fragile shale barren soils have been destroyed in some areas (Concannon pers. comm.).

No adverse cumulative effects are anticipated from MNF activities because authorized activities must be designed to avoid potential effects or they are prohibited on shale barrens. Exceptions are decided case-by-case in consultation with USFWS.

With no designated SBRC critical habitat on the MNF, continuing projects using the Forest Plan amendment standards and guidelines will not adversely modify or destroy critical habitat.

SUMMARY OF POTENTIAL EFFECTS ON THE SHALE BARREN ROCK CRESS

Potential Beneficial Effects:

1. Continue providing undisturbed SBRC habitat.

Potential Adverse Effects:

1. Road construction/reconstruction near SBRC habitat could decrease potential SBRC habitat.

2. Monitoring shale barren rock populations too frequently could decrease habitat suitability.

DETERMINATION

A NO EFFECT determination is made for regeneration harvest operations, thinning and single tree selection, TSI, prescribed fire, firewood cutting, gypsy moth, recreation, wildlife habitat improvement, fisheries improvements, range, and minerals activities. A MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for road construction/reconstruction.

MEASURES TO MINIMIZE POTENTIAL ADVERSE EFFECTS TO SHALE BARREN ROCK CRESS

The following measures are proposed to strengthen the MNF's ability to protect and manage SBRC habitat.

1. Update forest-wide standards/guidelines -2670, IV, Threatened and Endangered Species, A., 1. to include threatened and endangered plant species.

2. Continue analyzing potential projects for SBRC habitat. Conduct surveys in potential projects to avoid impacts.

3. Continue prohibiting ground-disturbing activities in shale barrens.

4. Continue consulting with USFWS for planned activities, including monitoring efforts, in SBRC habitat.

5. Continue implementing the Shale Barren Rock Cress Recovery Plan.

6. Limit road construction/reconstruction near Shale Barren areas

SMALL WHORLED POGONIA

Small whorled pogonia (*Isotria medeoloides*) (SWP) was listed as endangered on October 12, 1982. A recovery plan was completed in 1985 and revised in 1992. On October 6, 1994 SWP was downgraded to threatened status.

DISTRIBUTION

Small whorled pogonia is a broadly distributed orchid (Maine to Georgia), but populations are separated widely. Delaware, Tennessee, Ohio, and West Virginia were added to its range in the 1990s (USFWS 1992, Harmon pers. comm. 1997).

SWP has 3 population centers: Appalachian foothills in New England; Blue Ridge Mountains of North Carolina, South Carolina, Georgia, and Tennessee; and coastal plain and piedmont provinces of Virginia, Delaware, and New Jersey. New England populations exist in 53 sites (2200 stems), southern Blue Ridge in 15 sites (172 stems) and Virginia coastal/piedmont in 12 sites (250 stems). Other populations are much smaller.

In West Virginia, only one known SWP site exists. This population, near the Blue Bend Recreational site on the MNF, was discovered in fall 1997, after an extraordinarily wet summer. WV Natural Heritage Program surveyed several similar potential habitats in succeeding summer seasons, but no new populations were found.

REPRODUCTION

Leaf-whorl diameter predicts SWP's reproductive state for the following year (Mehrhoff 1989). Small plants are likely to be vegetative, go dormant, or die the next year. Large plants are likely to bloom the next year. An event that prevents a large plant from storing adequate energy (e.g., whorl loss early in the season due to grazing) may interrupt this sequence. In this case, a large orchid may reappear as a small vegetative plant or may not emerge the next year. A small vegetative SWP plant may be a seedling, young plant, or an older plant that did not flower previously; distinction is possible only by rootstock examination or annual monitoring of individual orchids.

SWP has staggered emergence, depending upon the individual orchid's reproductive status. Stems that form a flower bud usually emerge before vegetative plants. In its northern range, flowering plants emerge in May and flower fully in June. In Virginia, plants emerge in April to mid-May. In West Virginia's lower and warmer elevations (< 2600 ft), SWP generally emerges in May (Concannon, pers. obs 1998). Flowering occurs from June to early July. Individual orchids may stay in flower 4 days to 2 weeks (USFWS 1992).

SWP is primarily self-pollinating. The orchid's ovary falls as pollination begins, however, the fruit capsule does not ripen until autumn. Many plants form a visible over-wintering vegetative bud at the stem base in August or September (USFWS 1992).

GENERAL HABITAT CHARACTERISTICS

SWP occurs in a variety of habitats -- old disturbed pasture sites (80+ years) to mixed deciduous and deciduous/coniferous forest sites (30-80 years old). Most SWP sites share common characteristics, including relatively open understory canopy and proximity to logging roads, streams, or other features that create long forest canopy breaks (Mehrhoff 1989). Typical overstory and understory canopy associates in West Virginia include white pine (*Pinus strobus*), Virginia pine (*Pinus virginiana*), red oak (*Quercus rubra*), spicebush (*Lindera benzoin*), false ginseng (*Aralia nudicaulis*), white snakeroot (*Eupatorium rugosum*), and hog-peanut (*Amphicarpa bracteata*). These associates are part of the indicator suite for a white pine ecological association, which occurs in southern and drier parts of the MNF.

Slope, exposure, and topographic position vary throughout SWP's range. SWP occurs on easterly slopes in New England, while in West Virginia it occurs on southwesterly slopes. Mehrhoff (1989) found SWP on level terrain and on south- and southeasterly-facing slopes. Most Virginia colonies are on north- or northeast-facing slopes.

SWP occurs in water-sorted leaf litter along braided channels and vernal streams in Maine and New Hampshire (USFWS 1992), particularly in highly acidic, nutrient-poor soils. At some New England sites, impermeable soil layers (fragipan) prohibit percolation, creating moist conditions contrasting with the dry woodland habitat often described for this species.

HABITAT ON THE MONONGAHELA NATIONAL FOREST

In fall 1997, SWP was found on one site in the Land Type Association (LTA) Bd03 on the Marlinton/White Sulphur district. The ecological landtype is white pine (1081), which is described as low elevation, soils-MA, landform 32 (Concannon, 1999). The site is extremely productive orchid habitat. Showy lady's slipper (*Cypripedium reginae*) and pink lady's slipper (*Cypripedium acaule*) also grow at this site. The habitat includes dry forest associates (plant association 239/220, such as white pine, sassafras (*Sassafras albidum*), witch hazel (*Hamamelis virginiana*), spicebush, a shield fern (*Thelypteris goldiana*), and cinnamon fern (*Osmunda cinnamonea*). The area is traversed by 80+ year-old logging roads. While the local flora are described as dry woodland type, the relative humidity is higher than the surrounding landscape due to high temperatures and moisture from adjacent ephemeral streams. These local microclimatic conditions control SWP habitability, which can be difficult to predict.

Approximately 5000 ac (2023 ha) of the white pine, low elevation ecological landtypes of LTA Bd03 (DeMeo 1998) in the MNF have been surveyed for SWP. In addition, all proposed projects across the MNF have been surveyed. No new sites have been found.

No designated critical SWP habitat exists on the MNF.

CAUSES OF PAST/CURRENT DECLINES

Habitat destruction is the primary threat to SWP. Herbivory by deer and crickets (USFWS 1992), collecting, and damage from research activities are secondary. Residential and commercial developments have reduced SWP throughout its range.

A fence excludes deer from the showy lady's slipper population, 500 ft (152 m) southeast of the SWP population. Ten percent more vegetative species grow inside the fence than outside (USFS 1996). Furthermore, vegetation inside was taller and more productive. Thus, deer browsing may reduce SWP habitat quality throughout the MNF. Although herbivory can be detrimental for this species, SWP has maintained this small population outside the fenced area on the MNF.

Suitable SWP habitats may decline as canopies become denser and forest floor light is reduced.

FOREST PLAN STANDARDS AND GUIDELINES PERTINENT TO SMALL WHORLED POGONIA

General Forest-wide Page

SWP was listed as endangered in 1982, but it was not specifically addressed in the 1986 Forest Plan because it was not known to exist on the MNF until 1997. Consequently, the Forest Plan has no specific guidelines for SWP.

Appendix K
D1c(16) Threatened or endangered, and sensitive flora and fauna and their habitat will be protected. See Plan forest-wide standards and guidelines 2670, special zoological area standards and guidelines, namely Essential Habitat for Threatened and Endangered bats and Occupied Habitat for Virginia Northern Flying Squirrel (VNFS), Plan Appendices X (VNFS) and U (Sensitive Plant and Animal Species), and any recovery plans for threatened and endangered species K-15

EFFECTS OF CONTINUED IMPLEMENTATION OF THE FOREST PLAN

Regeneration Harvest, Thinning and Single Tree Removal, Timber Stand Improvement, Prescribed Fire, Road Construction/Reconstruction, Recreation, Wildlife Habitat Improvements, and Minerals.

The MNF has extensive acreage of potential SWP habitat. Proposed projects of this nature within potential SWP habitat are required to go through a project clearance process. Since its 1997 discovery on the MNF, all project activities have been analyzed for potential SWP habitat, and identified potential habitat has been surveyed. No new populations have been found. Projects may proceed where potential habitat does not exist. If populations were found in project areas the project would be redesigned or dropped to avoid affecting SWP.

Therefore, regeneration harvest, thinning, single tree selection, TSI, prescribed fire, road construction/reconstruction, recreation, wildlife habitat improvement, and mineral activity are unlikely to directly or indirectly affect SWP.

Firewood Cutting

Firewood cutting of dead and down trees is common on the MNF along open roads. The only known population of SWP on the forest is not located along an open road. The number of firewood permits and miles of open roads are limited, so the probability of affecting SWP by firewood cutting is discountable. Furthermore, some firewood cutting and gathering occurs when SWP is dormant. Therefore, firewood cutting will not likely directly, indirectly or cumulatively affect SWP.

Gypsy Moth

Dimilin, B.t., or Gypchek spraying to control gypsy moth would not directly affect SWP because it can self-pollinate. Thus, effects to non-target pollinators would not be detrimental to SWP.

Fisheries Improvements

Fisheries management is not likely to directly or indirectly affect SWP because most fisheries improvements are done in the stream channel. Current and future water quality improvements have been primarily limited to liming streams, which does not affect SWP habitat. Because of the limited extent and frequency of structural improvements, removal of trees for this type of work is minimal therefore chances of affecting SWP habitat is discountable.

Range

Future MNF range allotments are expected to remain similar to current levels, and no known SWP populations exist within current allotments. Further, the White Sulphur District, which holds only known SWP population of the MNF, has no range allotments. Therefore, SWP habitat changes are not expected from the MNF range program and range management is not likely to directly, indirectly, or cumulatively affect SWP.

SUMMARY OF CUMULATIVE EFFECTS

Since 1997, all project activities have been analyzed for potential SWP habitat; no new populations have been found.

Several surveys on private lands near the MNF in Pendleton County and near Charleston, WV (New River Gorge area) have been conducted (WV Natural Heritage Program 1999). Again, no new populations were found. Due to the inability to provide a federal nexus to many private lands, fewer surveys will be done on these lands.

SWP has a wide-ranging, though sparse distribution. Eighty percent of SWP populations are in New Hampshire and Maine (Sperduto1993). The remaining 20 percent are distributed in smaller, more isolated populations. Populations in West Virginia's and Virginia's Ridge and Valley areas do not appear to be on the fringe or genetic boundary of the species range.

The single known SWP population on the MNF is monitored and management activities at the site are avoided. No cumulative adverse effects to SWP are anticipated from MNF activities because of this protection. This site is surrounded by MNF lands so private land activities will not adversely affect this population.

SUMMARY OF POTENTIAL EFFECTS ON THE SMALL WHORLED POGONIA

Potential Beneficial Effects:

1. Thinning in areas adjacent to potential SWP habitat could increase habitat suitability by way of opening understory canopy.
2. Prescribed understory fire for oak regeneration could increase SWP habitat suitability.
3. Creating long forest canopy breaks.

Potential Adverse Effects:

1. Heavy ground disturbing activities in potential habitat could decrease SWP habitat suitability.

DETERMINATION

Based upon the information above, A MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT determination is made for all forest activities.

MEASURES TO MINIMIZE POTENTIAL ADVERSE EFFECTS TO THE SMALL WHORLED POGONIA

The following measures are proposed to strengthen the MNF's ability to protect and manage SWP habitat.

1. Update Forest-wide standards and guidelines - 2670, IV, Threatened and Endangered Species, A., 1. to include threatened and endangered plant species.
2. Continue evaluating potential projects for SWP habitat. Conduct surveys in potential SWP habitat before any project is implemented. If found, redesign or drop the project to avoid impacts.
3. Continue implementing actions in the Small Whorled Pogonia Recovery Plan.

VIRGINIA SPIRAEA

Virginia spiraea (*Spiraea virginiana*) (VS) was listed as threatened on June 15, 1990. A recovery plan was completed December 1991.

DISTRIBUTION

VS is known to exist on damp, rocky mountain river banks from West Virginia and Virginia to Tennessee, North Carolina and northern Georgia (Gleason and Cronquist 1991) that drain into the Ohio River basin. VS consists of 30 stream populations in six mid-Atlantic and southeastern states, down from 37 populations in 8 states (USFWS 1991(b)). In 1999, there was only one small population on the MNF, along the Greenbrier River in Greenbrier County. Twenty-six populations exist in West Virginia.

REPRODUCTION

VS is a perennial shrub with a modular growth form (USFWS 1991(b)). It is clonal with a root system and vegetative characteristics that allow it to grow under appropriate disturbance regimes along second and third order streams.

Reproduction is primarily asexual through clone or rhizome fragmentation and natural layering. Older clones sprout less and produce fewer rhizomes than young ones; however, well-established clones do bloom profusely over several weeks. (USFWS 1991(b))

Flower long-horn beetles, a flower beetle, and a soldier beetle are known to visit VS. Most flowers abort without producing follicles, but follicles are produced sporadically in most populations (USFWS, 1991).

Wind and water disperse their small seeds. However, seed production is rare, which may be attributable to only one genome being present in any given locality. (USFWS 1991)

GENERAL HABITAT CHARACTERISTICS

VS occurs along stream banks, usually at water's edge, of high-gradient second- and third-order stream reaches, or on meander scrolls, point bars, natural levees, and other lower-reach braid features near the stream mouth (USFWS 1991(b)).

HABITAT ON THE MONONGAHELA NATIONAL FOREST

The single MNF VS site exemplifies ideal VS disturbance-adapted shrub habitat (USFWS 1991(b)). VS is restricted to riparian topography where tree competition is inhibited by erosion. VS generally is associated with riparian vegetation including, but not restricted to eastern hemlock (*Tsuga canadensis*), sedges (*Carex spp*.), Rhododendron (*Rhododendron maximum*), and Carolina tassel-rue (*Trautvettaria caroliniensis*), in third-order streams at elevations above 2600 ft (790 m) where it is not overtopped by arboreal or fast growing herbaceous species.

Since its 1991 listing, the MNF has done VS surveys on approximately 60 miles of streams within 70,000 acres of project areas containing potential habitat. This habitat occurs primarily in the Marlinton/White Sulphur and Gauley districts. No new VS sites have been found on the MNF. Approximately 100-150 stream miles of potential VS habitat exist within potential project areas.

No designated critical VS habitat exists on the MNF.

CAUSES OF PAST/CURRENT DECLINES

Increased canopy closure or overtopping of trees during forest succession probably is the reason more VS sites do not exist due to this species' shade intolerance.

Other variables also may be affecting VS dispersal and viability. Channel destabilization resulting in excessive bank cutting and erosion affects VS and it's ability to remain rooted.

Non-native plant species also invade VS habitat, producing intense competition with and reducing habitat quality for dispersal of this mainly clonal species. Non-native competitors include annual grasses, red fescue (*Festuca rubra*), Japanese honeysuckle (*Lonicera japonica*), knotweed (Polygonum spp.) and multiflora rose (*Rosa multiflora*).

Currently, the biggest threat to West Virginia's VS populations may be ATV use (P. Harmon pers. comm. 1999). Some populations have been detrimentally affected by ATV usage off the forest.

FOREST PLAN STANDARDS AND GUIDELINES PEERTINENT TO VIRGINIA SPIRAEA

In 1986, when the Forest Plan was signed, VS was not a threatened species; therefore, the Forest Plan has no specific guidelines concerning VS.

However, today riparian protection and large wood recruitment are emphasized on the MNF to promote habitat restoration and maintenance, see the discussion under "Fisheries Improvements" in the first section of this document. These protections would likewise apply by association to VS.

EFFECTS OF CONTINUED IMPMENTATION OF THE FOREST PLAN

Regeneration Harvest, Thinning and Single Tree Removal, Timber Stand Improvement, Prescribed Fire, Road Construction/Reconstruction, Recreation, Wildlife Habitat Improvements, Minerals Activity and Land Ownership Adjustments.

The MNF doesn't actively manage areas where potential VS habitat occurs.

All proposed projects, including regeneration harvest, thinning/single tree selection, TSI, prescribed fire, road construction/reconstruction, recreation, wildlife habitat improvement, and minerals activity proposed project areas on the MNF are analyzed for VS habitat. Project areas that do not contain VS habitat may proceed. Project areas that contain potential VS habitat are surveyed for VS presence. If not found, the project may proceed. If VS is found, the project is redesigned or dropped to avoid potential species' effects. Because potential VS is found on larger streams and the MNF emphasizes riparian habitat protection, most activities are avoided rather than redesigned in potential VS habitat. Consequently, implementation of any of the above- mentioned activities is not anticipated to directly or indirectly affect VS.

Firewood Cutting
Firewood cutting of dead and down trees is common on the MNF along open roads. However, the number of firewood permits and miles of open roads are limited. VS is a shrub species and would not be a desirable firewood species, therefore the probability of directly affecting VS by firewood cutting is discountable. The odds of someone standing on a stream bank area that could support VS, cutting firewood there and crushing VS is also discountable. Therefore, firewood cutting will not directly, indirectly, or cumulatively affect VS.

Gypsy Moth
Pesticide spraying to control gypsy moth on the MNF has been reduced substantially since the 1996 population collapse. Research is lacking on pollinators and pollination of VS however beetles have been documented to visit VS. Dimilin, B.t., or Gypchek spraying to control gypsy moth would not directly affect VS because reproduction is primarily asexual through clone or rhizome fragmentation and natural layering. Thus, effects to non-target pollinators would not be detrimental to VS.

Fisheries Improvements
Fisheries management is not anticipated to directly or indirectly affect VS. Current and future water quality improvements have been primarily limited to liming streams, which does not affect VS habitat. Because of the limited extent and frequency of structural improvements, removal of trees for this type of work is minimal. Most work has been done in small streams that do not provide suitable VS habitat therefore chances of affecting VS habitat is discountable. This activity may also benefit VS by opening up the canopy.

Range
Future MNF range allotments are expected to remain similar to current levels, and no known VS habitat or populations exist within current allotments. Therefore, VS habitat changes are not expected from the MNF range program, and range management will not directly or indirectly affect VS.

SUMMARY OF CUMULATIVE EFFECTS

The MNF requires VS surveys for ground disturbing activities in suitable habitat. The MNF has completed VS surveys in every project area containing such habitat. The only known MNF population occurs along the Greenbrier River where no management will occur.

The MNF protects riparian habitat which helps conserve potential VS habitat and encourages dispersal along streams within the MNF. Principal threats to VS are the unnatural flooding regimes and channel destabilization created by flood control projects on private land, and non-native vegetation invasion and competition along many riverine systems. Off-road ATV use, which has been documented as a threat, is not allowed in the MNF. Since most known VS populations occur in 8 other states, most of its range is outside of the MNF. As a result, Forest Plan activities would not cumulatively affect overall VS populations.

Because no designated critical VS habitat exists on the MNF, adverse modification or destruction of critical habitat will not occur by continuing projects implemented under the current, amended Forest Plan.

SUMMARY OF POTENTIAL EFFECTS ON THE VIRGINIA SPIRAEA

Potential Beneficial Effects:

1. Riparian protection, natural large wood recruitment for habitat restoration and maintenance, and watershed health are emphasized on the MNF which helps conserve potential VS habitat and encourages dispersal along streams. Most timber harvesting projects now employ riparian protection guidelines as mitigation measures. Although commercial harvest is limited in riparian areas, these guidelines do allow for activities that will enhance riparian values such as thinning to favor early successional, riparian dependent species such as VS.

Potential Adverse Effects:

1. Non-native plants could compete for and decrease potential VS habitat.

DETERMINATION

Based the above information A NO EFFECT determination is made for regeneration harvest, thinning and single tree selection, TSI, prescribed fire, firewood cutting, gypsy moth, road construction/reconstruction, recreation, wildlife habitat improvements, fisheries improvements, range, minerals activities, and land ownership adjustments.

MEASURES TO MINIMIZE POTENTIAL ADVERSE EFFECTS TO VIRGINIA SPIRAEA

The following measures are proposed to strengthen the MNF's ability to protect and manage VS habitat.

1. Update Forest-wide standards and guidelines - 2670, IV, Threatened and Endangered Species, A., 1. to include threatened and endangered plant species.

2. Continue protecting riparian habitat. Identify potential VS sites for non-commercial treatments (thinning) that would favor VS.

3. Continue analyzing potential projects for VS habitat. Conduct surveys in potential VS habitat before implementing any project. Redesign or drop potential projects to avoid VS impacts.

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APPENDICES

APPENDIX 1. SUMMARY OF FOREST PLAN MANAGEMENT PRESCRIPTIONS

MP	Desired Land Condition	Acreage and Percent
mp 1.1	Location of mineral extraction development	1,100 acres 0.1%
mp 2.0	A continuous forested scene; wildlife species primarily associated with shade-tolerant vegetation; primarily - shade-tolerant hardwood trees for fiber and sawtimber achieved through uneven-aged management.	22,500 acres 2.5%
mp 3.0	A variety of forest views; a primarily motorized recreation environment; large, high quality hardwood trees for lumber and veneer, hard mast production and scenic attributes; wildlife species tolerant of disturbances.	198,887 acres 21.8%
mp 4.0	A variety of coniferous forest views and scenes; a primarily motorized recreational environment; wildlife species associated with conifers; soft-wood trees for fiber and lumber.	3,300 acres 0.4%
mp 5.0	Protects the wilderness attributes for future generations; provides a wilderness exper-ience, preserves natural ecosystems.	78,100 acres 8.6%
mp 6.1	Remote habitat for wildlife species intolerant of disturbance; a mix of forest products; a predominantly semi-primitive, non-motorized recreational use.	461,063 acres ++ 50.7%
mp 6.2	A semi-primitive non-motorized recreation environment; allows for various dispersed recreational activities and remote wildlife habitat. No timber harvest anticipated.	124,500 acres 13.7%
mp 7.0	A high density, self contained forest recreation environment (eg. developed recreation sites)	700 acres 0.1%
mp 8.0	The preservation of unique ecosystems, areas to conduct research, the protection of unique areas of natural significance.	12,856 acres 1.4%

(++ Includes the Mower Tract (40,745 ac.) acquired in 1989.)

As of this writing the decision in which MP the recently acquired Dolly Sods North tract (6,168 ac. = 0.7%) will be placed has not been made. Therefore, the above figures do not match total forest ownership reported elsewhere.

*APPENDIX 2. FOREST TYPES**

a. Approximately 525,717 acres (59.6%) of the Forest consists of the northern hardwoods type group, which includes the following specific forest types:

- sugar maple, beech, yellow birch
- sugar maple, basswood
- black cherry, white ash, yellow poplar
- red maple (dry)
- sugar maple
- american beech
- sugar maple, beech, yellow birch, red spruce
- mixed hardwoods*
- quaking aspen
- yellow birch
- bigtooth aspen

* mixed hardwoods consists of maple, basswood, ash, birch, northern red oak, yellow poplar and black cherry.

b. Approximately 280,219 acres (31.8%) of the Forest is composed of oak forest types, which include the following specific forest types:

- oak, white pine
- oak, yellow pine
- chestnut oak
- black oak, scarlet oak
- white oak
- northern red oak
- yellow poplar, white oak, northern red oak
- mixed oaks

c. Approximately 43,373 acres (5.0%) of the Forest is composed of conifer types, which include the following specific forest types:

- red pine
- white pine
- white pine, hemlock
- hemlock
- conifers
- red spruce, balsam fir
- tamarack
- white spruce, norway spruce, balsam fir
- virginia pine
- pitch pine

Appendix 2. Forest Types (con't)

Minor, but ecologically important components of the Forest include:

d. Miscellaneous forest types covering 1,232 acres or 0.1% of the Forest.
- river birch, sycamore
- red maple (wet)
- green ash
- black walnut
- black locust

e. Upland and lowland brush which cover 6,564 and 1,986 acres respectively or 1.0% of the Forest.

f. Open/grass/herbaceous covering 22,352 acres or 2.5% of the Forest.

*Forest types listed above do not include by name every tree species that occurs on the MNF. Several tree species are not listed because they do not occur frequently enough to be named as a forest type.

APPENDIX 3. HARVEST

ACRES MANAGED THROUGH COMMERCIAL TIMBER SALE ACTIVITIES
BY HARVEST METHOD AND YEAR SOLD
MNF
1987 THROUGH 1998

YEAR	ACRES CLEAR CUT	ACRES SHLTWD	ACRES 2-AGED	ACRES SELECTN	ACRES THIN	TOTAL ACRES
1998	0	49	509	52	499	1,109
1997	157	0	324	314	1,632	2,427
1996	441	34	38	3	419	935
1995	702	0	482	0	2,470	3,654
1994	1,139	69	368	208	2,574	4,358
1993	1,350	0	68	119	3,315	4,852
1992	1,108	0	25	92	3,535	4,760
1991	1,738	0	0	215	4,436	6,389
1990	1,654	46	0	54	3,927	5,681
1989	1,366	0	0	12	4,647	6,025
1988	1,184	0	0	1,535 *	2,178	4,897
1987	1,250	14	0	307	1,997	3,568
87 -98 ANNUAL AVG	**1,007**	**18**	**151**	**243**	**2,636**	**4,055**
95-98 ANNUAL AVG	**325**	**21**	**338**	**31**	**1,255**	**2,031**

* Most of these acres were a one-time conversion cut designed to help move an even-aged area toward an uneven-aged area.

Appendix 3 (con't)

TIMBER VOLUMES
MNF
1987 THROUGH 1998

YEAR	VOLUME OFFERED	VOLUME SOLD	VOLUME HARVESTED
1998	14.6	9.9	24.5
1997	17.0	12.7	25.2
1996	15.2	12.2	28.3
1995	29.7	25.6	22.1
1994	32.8	26.7	20.9
1993	30.0	30.0	33.5
1992	38.7	35.4	36.6
1991	39.0	39.0	36.4
1990	39.1	34.0	28.3
1989	40.5	39.0	36.9
1988	40.1	36.0	50.7
1987	34.3	27.6	36.0
87 -98 ANNUAL AVG	**30.9**	**27.3**	**31.6**
95-98 ANNUAL AVG	**19.1**	**15.1**	**25.0**

APPENDIX 4. ROADS

ROAD INFORMATION

Road Mileage Changes							
Year	Miles of System Road				Miles of Woods Road		Grand
	Abandoned	Built	Added	Total	Abandoned	Total	Total
1986	----	----	----	1207	0	1835	3042
1987	18	25	77	1291	77	1758	3049
1988	3	13	59	1360	81	1677	3037
1989	0	26	14	1400	18	1659	3056
1990	3	36	67	1500	34	1625	3125
1991	15	23	0	1508	16	1609	3117
1992	2	21	0	1527	24	1585	3112
1993	5	17	12	1539	0	1585	3124
1994	1	23	22	1561	2	1583	3144
1995	0	19	19	1580	36	1547	3127
1996	0	11	11	1591	0	1547	3138
Subtotal	47	214	281	+384	288	(-288)	+96

Road Densities By Management Area								
Fiscal Year	Mgmt. Area	Area Sq. Mi.	Collector Miles	Collector Mi/Sq Mi	Forest Plan Std	Local Miles	Local Mi/Sq Mi	Forest Plan Std
1988	2.0	35	11.8	0.34	1.0	10.3	0.29	3.0
	3.0	304	84.2	0.27	1.0	149.6	0.49	3.0
	4.0	5	6.0	1.20	1.0	9.0	1.80	3.0
	6.1	660	384.5	0.58	1.0	401.2	0.61	1.5
1989	2.0	35	11.8	0.34	1.0	10.3	0.29	3.0
	3.0	304	117.9	0.39	1.0	128.8	0.42	3.0
	4.0	5	4.4	0.88	1.0	9.0	1.80	3.0
	6.1	660	377.9	0.57	1.0	418.3	0.63	1.5
1990	2.0	35	11.8	0.34	1.0	6.7	0.19	3.0
	3.0	304	129.3	0.43	1.0	127.3	0.42	3.0
	4.0	5	4.4	0.88	1.0	9.0	1.80	3.0
	6.1	660	409.4	0.62	1.0	455.3	0.63	1.5
1991	2.0	35	11.8	0.34	1.0	9.4	0.27	3.0
	3.0	304	122.1	0.40	1.0	140.1	0.46	3.0
	4.0	5	4.4	0.88	1.0	10.4	2.08	3.0
	6.1	660	413.5	0.63	1.0	480.2	0.73	1.5
1992	2.0	35	11.8	0.34	1.0	10.3	0.29	3.0
	3.0	304	124.5	0.41	1.0	148.2	0.49	3.0
	4.0	35	4.4	0.88	1.0	10.4	2.08	3.0
	6.1	660	413.5	0.63	1.0	486.7	0.74	1.5
1993	2.0	35	11.8	0.34	1.0	10.3	0.29	3.0
	3.0	304	124.5	0.41	1.0	158.2	0.52	3.0
	4.0	35	4.4	0.88	1.0	10.4	2.08	3.0
	6.1	660	413.5	0.63	1.0	488.7	0.74	1.5
1994	2.0	35	11.8	0.34	1.0	10.3	0.29	3.0
	3.0	304	124.5	0.41	1.0	163.5	0.54	3.0
	4.0	5	4.4	0.88	1.0	10.4	2.08	3.0
	6.1	660	419.2	0.64	1.0	499.2	0.76	1.5
1995	2.0	35	11.8	0.34	1.0	10.3	0.29	3.0
	3.0	304	124.5	0.41	1.0	163.7	0.54	3.0
	4.0	5	4.4	0.88	1.0	10.4	2.08	3.0
	6.1	660	422.7	0.64	1.0	508.7	0.77	1.5
1996	2.0	35	11.8	0.34	1.0	10.3	0.29	3.0
	3.0	304	124.5	0.41	1.0	171.8	0.57	3.0
	4.0	5	4.4	0.88	1.0	10.4	2.08	3.0
	6.1	660	422.7	0.64	1.0	511.7	0.78	1.5

Appendix 4 (con't)

Monongahela Road System CLOSURE Status

Monongahela System Road CLOSURE Status								
Year	Status							
	Open Yearlong		Closed Yearlong		Closed Seasonally		Totals	
	Miles	%	Miles	%	Miles	%	Miles	%
1987	439	34	684	53	168	13	1291	100
1988	413	30	776	57	171	13	1360	100
1989	451	32	764	55	185	13	1400	100
1990	511	34	785	52	204	14	1500	100
1991	507	34	803	53	198	13	1508	100
1992	509	33	825	54	193	13	1527	100
1993	513	33	831	54	195	13	1539	100
1994	519	33	843	54	199	13	1561	100
1995	524	33	851	54	205	13	1580	100
1996	526	33	757	54	208	13	1591	100
10 Yr Ave.	491	33	802	54	193	13	1486	100

Monongahela Road System **CURRENT** Status

Monongahela System Road CLOSURE Status								
Year	Status							
	Open Yearlong		Closed Yearlong		Closed Seasonally		Totals	
	Miles	%	Miles	%	Miles	%	Miles	%
1999	538	30	1096	61	152	9	1786	100

APPENDIX 5. MANAGEMENT ACTIVITIES

TEN YEAR SUMMARY OF SELECT MANAGEMENT ACTIVITIES

OUTPUTS												
Activity (unit of measure)	Plan Ave	1987 Actual	1988 Act.	1989 Act.	1990 Act.	1991 Act.	1992 Act.	1993 Act.	1994 Act.	1995 Act.	1996 Act.	10 Yr. Ave.
Range Structure (Structures)	----	----	----	----	----	21	24	15	13	10	8	9
Timber Vol. Sold (mmbf)	40	30	36	40	34	39	39	30	33	30	15	32.6
Natural Reforestation (acres)	1447	1361	1593	1896	1375	2125	1715	2094	1566	1261	1359	1644
Tmbr Stand Improv (acres)	1200	1574	811	625	507	1044	1002	822	1123	1013	888	941
Clearcut Area (acres)	1625	1250	1184	1366	1654	1738	1108	1343	418	139	480	1231
Soil/Water Improv (acres)	50	10	5	15	15	7	70	203	41	67	13	45
Mineral Activ (permits/leases)	37	74	81	56	56	55	47	166	98	66	98	80
Human Resource (enrollee yrs)	24	72	58	58	78	93	51	36	37	43	41	57
Land Acquisition (acres)	1750	28134	17114	0	14	16233	166	6723	----	70	270	6872
Land Acquisition (acres in NRA)	325	535	3	341	7	40	0	0	0	53	0	98
Landline Location (miles)	52	42	50	111	49	46	48	51	38	31	20	49
Road Construct (miles)	25	22	17	26	17	28	17	17	23	19	11	20
Road Reconst (miles)	15	12	4	7	14	55	19	----	17	32	9	17

APPENDIX 5 (con't)

OUTPUT VARIATION (1987-1996)				
Activity, (unit of measure)	Plan Ave.	Lowest Output (Year) % of Plan Ave.	Highest Output (Year) % of Plan Ave.	10 Yr. Ave. % of Plan Ave.
Range Structure (Structures)	----	---- 1987-90 ----	24 1992 ----	9 -----
Timber Volume Sold (mmbf)	40	30 1987,93,95 75%	40 1989 100%	29 73%
Natural Reforestation (acres)	1447	1261 1995 87%	2125 1991 147%	1644 114%
Timber Stand Improv (acres)	1200	507 1990 42%	1574 1987 131%	941 78%
Clearcut Area (acres)	1625	139 1995 9%	1738 1991 107%	1231 76%
Soil / Water Improve (acres)	50	5 1988 10%	203 1993 406%	45 90%
Minerals Activity (permits/leases)	37	47 1992 127%	166 1993 449%	80 216%
Human Resource (enrollee yr.)	24	36 1993 150%	93 1991 388%	57 238%
Land Acquisition (acres)	1750	0 1989,94 0%	28134 1987 1608%	6872 393%
Land Acquisition (acres in NRA)	325	0 1992-94, 96 0%	535 1987 165%	98 30%
Landline Location (miles)	52	20 1996 38%	111 1989 213%	49 94%
Road Construct (miles)	25	11 1996 44%	28 1991 112%	20 80%
Road Reconstr (miles)	15	---- 1993 0%	55 1991 367%	17 113%

APPENDIX 5 (con't)

Vegetation Manipulation

Type of harvest	Plan Ave. Acres	1987 Acres Sold	1988 Acres Sold	1989 Acres Sold	1990 Acres Sold	1991 Acres Sold	1992 Acres Sold	1993 Acres Sold	1994 Acres Sold	1995 Acres Sold	1996 Acres Sold	10 Yr. Ave. Acres
Salvage	-----	35	31	32	826	910	386	642	1138	392	278	467
Clearcut	1625	1250	1184	1366	1654	1738	1108	1343	418	139	480	1231
Selection	350	307	1535	12	54	215	92	118	208	237	113	324
Thinning	3892	1945	2047	4584	302	3518	2947	2673	1430	1841	730	2861
Shelter-wood	160	17	0	0	63	0	25	0	69	482	34	85
Removal	-----	0	10	31	36	8	202	1	6	0	0	38
Seed Tree	-----	14	0	0	46	0	0	10	0	0	0	7
Alt. Hrvst.	-----	0	0	0	0	0	0	65	1089	698	38	189
Misc	-----	35	0	64	94	88	128	60	86	101	128	78
Savannah	-----	-----	-----	-----	-----	-----	-----	-----	-----	129	111	24
Harvest Total	6027	3603	4897	6089	5775	6477	4888	4912	4444	4019	1912	5304

Appendix 6. Bat Surveys

SUMMARY OF BAT SURVEYS CONDUCTED IN WEST VIRGINIA

Considerable effort has been made with the hope of documenting the presence of Indiana bats in West Virginia. In summer 1986, the USFWS conducted a study to assess and document riparian habitat use by endangered bats for a proposed dam on the Greenbrier River. Four suitable mist net sites were selected on the Greenbrier River between Cass and Marlinton. These sites are within the MNF proclamation boundary. Mist net surveys were conducted July 14-17 and July 21-24. A total of 133 individuals of five species were captured. No Indiana bats were captured during this effort (Kulp 1987).

On August 25- 26, 1994, six coalmine portals along the Cherry River on the Gauley Ranger District in Nicholas County were surveyed for bats with mist nets and harp traps. Thirty bats of three species were captured. None were Indiana bats (Hall 1994).

During the summer and fall, 1995, the WVDNR conducted bat surveys near Big Springs Cave on the Fernow Experimental Forest to determine the presence or absence of Indiana bats. Mist nets were placed in potential travel corridors, over a small reservoir or over streams within two kilometers of the cave, and a harp trap was used at the entrance to Big Springs Cave. Eleven trapping sessions, usually two nights per month, were conducted between April and November. During the trapping sessions, a total of 1,054 bats of nine species were captured. The first documented occurrence of Indiana bats in WV during the summer months was recorded with the capture of a few (1 in June, 5 in July) male Indiana bats. The first female Indiana bat was captured in mid August at the entrance to Big Springs Cave. A total of 69 Indiana bats were eventually captured during this study, of which five were females. This study showed no indication that Indiana bat maternity colonies occur in the area; however, it does indicate that some of the male Indiana bats stay in the vicinity of this winter hibernaculum through the summer (Stihler 1996).

In early August, 1996, the WVDNR coordinated a three-night bat survey with mist nets on some of the Ohio River Islands in the western portion of WV. Sixteen bats of five species were captured. None were Indiana bats (Stihler 1996).

During July and August, 1997, MNF biologists and other MNF employees, working cooperatively with other federal, state and private agencies, volunteers and contractors, carried out bat mist net surveys in six MNF project areas. For each project area a minimum of ten mist net sites were operated for three nights. Each mist net site consisted of 1-4 single or double high mist nets. Mist nets were placed in areas considered to have the highest potential to capture bats within the project area. Nets were placed over such locations as wildlife ponds/waterholes and road rut ponds where bats often come to drink or search for emerging aquatic insects. Nets were also placed across grassy roads within the generally heavily forested areas that bats often use for traveling to and from feeding and roosting areas, or for feeding. These surveys, documented 274 bats of eight species. No Indiana bats were captured during these efforts.

Between August 5-11, 1997, Environment and Archaeology, LLC conducted mist netting surveys for Cabot Oil and Gas Corporation on the MNF. This survey was conducted in conjunction with proposed natural gas development (Hightown pipeline and connection of two new wells to the existing Thornwood pipeline) within the Smokecamp Opportunity Area on the Greenbrier Ranger District. Mist nets in the vicinity of each proposed pipeline corridor were run for three nights. Only one northern long-eared bat was captured (Environment and Archaeology, LLC, 1997).

In another WVDNR study in September, 1997 around Big Springs Cave, mist nets were set up within 2 kilometers of the cave entrance and a harp trap was placed in the cave entrance. One hundred nineteen bats were captured before four male Indiana bats were caught at the cave entrance while attempting to enter the cave to night roost. These four male Indiana bats were fitted with radio transmitters and monitored for the following ten days. Eleven roost sites were identified and used by three of the four bats; the farthest roost was located 3.5 miles from the hibernaculum. Both snags and live trees were used as day roosts and the bats often changed roost from one night to the next. One bat roosted in a child's playhouse.

On September 18, 1997, four abandoned coal mine portals near Little Fork on the Gauley Ranger District were mist netted for bat use. Three bats of three species were captured entering mine portal A. None were Indiana bats (Stihler 1997).

In 1998 the MNF hired a seasonal crew of seven people. This crew worked along with MNF wildlife biologists and technicians. Nine project areas were mist netted for bats. In each project area a minimum of five net locations were operated for three nights. Each net location consisted of several single and /or double high nets. Similar to 1997 MNF surveys, nets were placed over ponds, road ruts, riparian areas or woods roads within the proposed project area. Bats captured were identified by a person holding a valid WV scientific collecting permit and qualified to identify Indiana bats. In this effort 439 bats of nine species were captured. No Indiana bats were captured.

This summer crew also surveyed six areas of the MNF, which were felt to have high potential for Indiana bat occurrences. Mist netting efforts varied from 2-5 net sites per area. Areas were netted 1-3 nights. During this effort, 365 bats of eight species were captured, however, no Indiana bats were captured.

A crew of West Virginia University wildlife technicians and bat researchers from Westvaco Corporation surveyed five different areas between June 6-August 7 1998. A total of 44 bats of seven species were captured. No Indiana bats were documented from this effort.

On June 23-25, 1998, WVDNR mist netted for bats at and in the vicinity of the Tower Road on North Fork Mountain on the MNF. These mist net stations were operated within LTA Aa01. Sixty-seven bats of seven species were captured. No Indiana bats were captured (Stihler, 1998).

Throughout the summer, 1998 and 1999, a Frostburg State University graduate student conducted a bat study on the MNF. He placed anabat detectors (used for recording echolocation calls) in various forest types and seral stages across the Forest to determine summer bat use. These "calls" will be used to develop a local "call" library of bat species of WV. Through the use of computers he could then use the call library to identify the species of bats recorded by the anabat detectors in the various locations and habitats on the Forest. The results of the anabat work are not yet available. This student mist netted at twelve areas during 1998. Eleven of these twelve areas were on or within the MNF proclamation boundary. One area was just north of the Forest at Maysville, WV. During his mist netting he captured 78 bats of seven species. None were Indiana bats. (O'Malley, 1998)

During the summer of 1998, bat researcher Alex Menzel and his assistants, conducted 176 mist-net nights of bat surveys on the Westvaco Wildlife and Ecosystem Research Forest. This Forest is in Randolph County southwest of Dailey, WV and only a few miles west of the MNF. It occurs in the Allegheny Plateau section, similar to much of MNF lands. During these surveys 132 bats of seven species were captured. None were Indiana bats.

During the summer of 1998, Dr. Gannon of Pennsylvania State University conducted bat surveys for the proposed Federal Highway Elkins bypass project. Elkins is just west of the MNF and its proclamation boundary. Both mist netting and anabat detectors were used to survey for bats at intervals along the proposed corridor. As of this writing the analysis and report of the bat calls recorded via anabat detectors have not been completed. However no Indiana bats were captured through the mist netting completed (Tolin, pers. comm., 1998).

The evening of September 11, 1998 endangered species personnel of the WVDNR operated four mist nets in the riparian area of Island Lick Run at Watoga State Park. This state park is within the proclamation boundary of the MNF south of Marlinton. Twenty-five bats of four species were captured. No Indiana bats were captured in this effort (Stihler, 1998).

In July and August of 1999, nine areas were mist netted across the MNF by contractors. In each project area a minimum of four net locations were operated for two nights. Each net location consisted of several single and /or double high nets. Nets were placed over ponds, road ruts, riparian areas or woods roads within these areas. Bats captured were identified by a person holding a valid WV scientific collecting permit and qualified to identify Indiana bats. In this effort 856 bats of nine species were captured. No Indiana bats were captured. One of these contractors also checked under bridges to see if any Indiana bats were night roosting there. A juvenile male Indiana bat was found on August 5th under one of these bridges.

In July of 1999, WVDNR surveyed two areas outside the MNF. One area is a Cabwaylingo State Forest in Wayne County, WV and in this location they used 11 nets over 2 nights. They captured 26 bats of 4 species. The other was Pleasant Creek Wildlife Area in Barbour and Taylor Counties, and in this location they used 9 net sites over 2 nights, and captured 84 bats of five species.

During the summer of 2000, 9 areas were surveyed across the MNF by contractors and FS personnel. Areas had from 2 to 9 net site locations, each site location with at least 2 nets. Bridges in these areas were also checked for night roosting bats. This effort resulted in the capture of 122+ bats of ?8 species, including one adult male Indiana bat at a net 5.5 miles from the nearest hibernaculum.